USDA-FOREST SERVICE

Salmon National Forest

Air Resource Management Program

Including Portions

of

the Frank Church-River of No Return Wilderness

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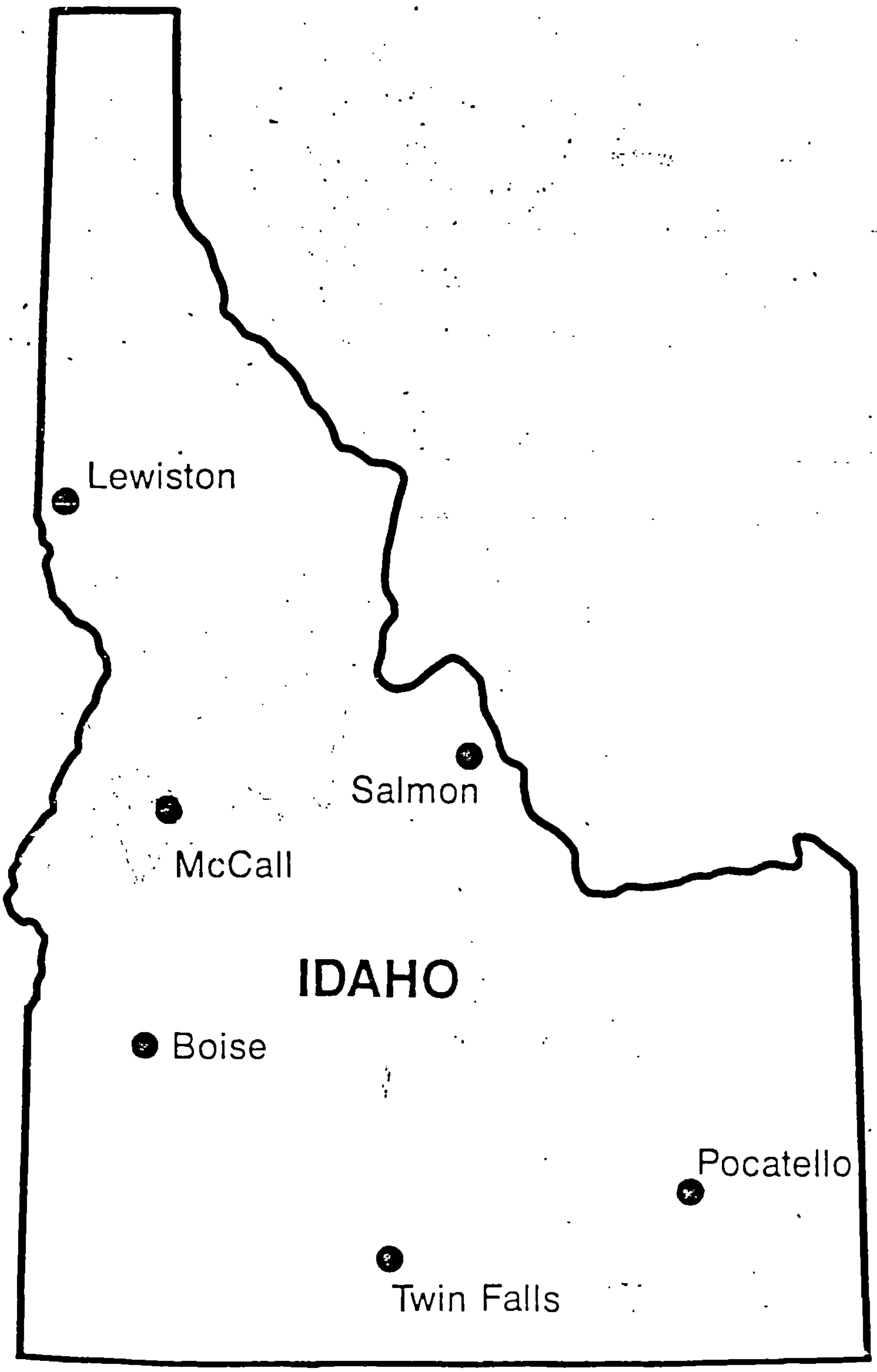
TABLE OF CONTENTS



vicinity map

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INTRODUCTION

The Frank Church--River of No Return Wilderness (FC--RONRW), established by Congress in 1980, totals approximately 427,315 acres on the Salmon National Forest. The Salmon River Mountains have outstanding wilderness qualities and are geologically unique. The wilderness portion of the Salmon River Mountains and Clearwater Mountains is composed of granitic rock from the Idaho Batholith which is between 85 to 95 million years old (Mesozoic Era). Within the Idaho Batholith and within the FR-RNRW on the Salmon National Forest is a high elevation craggy peak and cirque lake area called "Bighorn Crags." This area is composed of quartz monzonite stock called the "Crags Pluton." Estimated age is about 45 million years old formed during the Tertiary Period. Elevations range from 2,875 feet in forested canyons to above timberline at elevations of 10,082 feet atop Mt. McGuire. Below the main high elevation ridges, the topography is divided into numerous alpine basins, picturesque lakes and meadows. There are about 123 lakes, including ponds in the wilderness portion of the Salmon National Forest.

The balance of the Salmon National Forest geology is extremely diverse and complex. The dominant rock type throughout the Forest is Precambrian sedimentary including quartzites and siltites of the Yellowjacket formations, Lemhi Group and Swager formations. Paleozoic and Mesozoic sedimentary rocks including quartzites, mudstones, sandstones, siltstones, dolomites, limestones, conglomerates, cherts, shales, and phosphatic shales are found in the Lemhi Range and south end of the Beaverhead Mountains. Tertiary sedimentary rocks are found in minor lacustrine deposits in the Leesburg and Moose Creek Basins and in minor exposures of the Greetson formation in the Fourth of July Creek vicinity. Intrusive igneous pluton rocks are also common in the west, northwest, and specific eastern portions of the Forest and include granite and quartz monzonites, ranging in age from 44 to 50 million years old and of the Idaho Batholith about 85 to 95 million years old. Tertiary granite rocks are pink in color caused by pink potassium feldspar, whereas the Idaho batholith granite is gray in color. Tertiary plutons are thought to have been emplaced within 3 to 4 miles of the earths surface, whereas the Idaho batholith may have been emplaced more than 6 miles from the earth surface. The surface exposure of the granite rocks shows approximately how much soil and rock has been eroded since their creation. Augen Gneiss found near Shoup has been dated at 1.5 billion years old. Other rocks along the Salmon River are estimated to be at least 2.5 billion years old. Extrusive igneous rocks within the Forest include widespread andesite, dacite, rhyolite, and basalt flows of the Challis volcanics with an estimated age between 45 to 50 million years old. Late Tertiary ash deposits are found in the Leesburg Basin. Parts of the Forest contain ash from Mt. Mazama (Crater Lake, Oregon) 6,500 years old and/or otherlocal volcanic eruptions towards Challis. High elevation glaciated areas are found in the Lemhi Mountains, Beaverhead Mountains, Clearwater Mountains and the Salmon River Mountains.

In 1985, the EPA and Forest Service Western Lake Survey, in cooperation with the National Acid Precipitation Assessment Program, sampled six lakes within the Salmon National Forest, four which were in the FC--RONRW. Phase I of the National Surface Water Survey was designed to quantify the chemistry of lakes

believed to contain low acid neutralizing capacity (ANC) water throughout the United States. Results indicated that three of the six lakes sampled are classified as "ultra-sensitive" to potential acidification due to extremely low acid neutralizing capacity. Results of the "Western Lake Survey Phase 1" by D. H. Landers and J.. Eilers et. al, January 1987, EPA/600/3-86/054a. Preliminary results show that no lake acidification was found in Idaho and the "acid neutralizing capacity" (ANC) in the Idaho batholith was encouraging, survey results did indicate that some Idaho lakes show extreme sensitivity to acid rain based on their low ANC.

The Regional Forester's responsibilities as the designated Federal Land Manager include implementation of the 1964 Wilderness Act, the 1977 Clean Air Act, the 1968 Wild and Scenic River Act, Research Natural Areas, and the 1988 Idaho Air Quality State Implementation Plan. Forest Supervisors are responsible to take action to protect resources of the National Forest System lands from adverse impacts which may result from air pollution and atmospheric deposition.

This Action Plan specifies the Forest Service Air Resource Management Program for the Salmon National Forest and portions of the Frank Church--River of No Return Wilderness. The objectives of this Action Plan are to define Forest Service policy, identify Air Quality Related Values (AQRV's), select sensitive receptors, and outline action for monitoring selected sensitive receptors. By meeting these objectives the Forest Service will be able to review Prevention of Significant Deterioration (PSD) permit applications and associated adverse impact determinations and provide timely meaningful recommendations to regulators. This data will also aid the State of Idaho, other Forests and Regions.

Cooperation with Federal, State, local agencies, and private groups and individuals is an important aspect of the air management program. The Action Plan will be used as the basis for information exchange and in developing cooperative monitoring.

The FC--RONRW portion of the Salmon National Forest, especially the Crags area is a popular recreation area. Over 285 miles of trails provide access to the wilderness on the Salmon National Forest portion. Many trails are heavily used and severely impacted in certain areas, mainly from the use of horses on the shallow, fragile granitic soils. Commercial outfitter guides conduct fishing, hunting and sightseeing trips into this area. Visitor use of the Salmon National Forest portion of the FC--RONRW in 1988 was 39,000 visitor-days.

The potential for air pollution impacts in the FC--RONRW portion of the Salmon National Forest is unknown at this time. Strong southwest to west prevailing winds transport potential emissions from Boise, Idaho, and California, Oregon, and possibly Washington. Strong northwest prevailing winds transport potential emissions from northern Idaho, especially during large wildfires, and possibly Washington and western Canada. These emissions generally follow the Salmon River in an eastward direction. The nonwilderness portion of the Salmon National Forest obtains its emissions from wildfires and prescribed fires from within the Forest and from the Challis National Forest, sawmill operations in Salmon, dust from roads, logging operations and spring burning of agricultural lands in the valley's, in addition to the above locations depending on the wind pattern.

ACTION PLAN OBJECTIVES

This Action Plan provides a mechanism to implement the policies outlined in the 1964 Wilderness Act, the 1977 Clean Air Act, the 1988 Idaho Air Quality Implementation Plan, the Salmon National Forest Plan and the Frank Church--River of No Return Wilderness Management Plan. The objectives of the Action Plan are as follows:

1. Define Frank Church--River of No Return Wilderness Air Resource Policy. (Potential for Class 1 Airshed in the future).

2. Define the Salmon National Forest Air Resource Policy (Excluding FC--RONRW)

3. Define Air Quality Related Values (AQRV's) and possible air pollution impacts.

4. Identify sensitive receptors for each AQRV.

5. Develop action items which outline direction for establishing detailed AQRV Monitoring Plans which will determine baseline conditions and impacts on selected sensitive receptors.

6. Document existing data available which establishes baseline physical, chemical, and/or biological conditions of identified sensitive receptors. Establish format for documentation and analysis of future monitoring activities.

7. Identify Forest Service cost for the Air Resource Program and for the implementation of monitoring AQRV's as outlined in the Action Plan.

8. Cooperate with Federal, State, and local agencies and develop contacts with various private and public organizations to determine areas of mutual concern, including possible cooperative monitoring programs.

WILDERNESS AND AIR RESOURCE MANAGEMENT POLICIES

The 1964 Wilderness Act directs the Forest Service to protect National Forest System Wilderness from any man-caused degradations not specifically allowed by law. The Wilderness Act gives the Forest Service the ability to take action against sources of air pollution affecting a wilderness, but probably only after an effect has occurred.

The statutes specifically providing for pre-emptive protection of visibility from air pollution are the Clean Air Act Amendments of 1977. The 1977 Federal Clean Air Act in its Prevention of Significant Deterioration (PSD) section authorizes Federal Land Managers (FLM) to make recommendations to State and Federal licensing agencies regarding applications for air polluting activities before licensing. It also requires the states in their State Air Quality Implementation Plans and the EPA to consider recommendations of the FLM.

Wilderness established prior to enactment of the 1977 Federal Clean Air Act are designated Class I airsheds. Wilderness areas established after September 1977 are Class II airsheds. Forest Service policy calls for affirmative protection of Air Quality Related Values (AQRV's) in Class I wilderness areas, maintenance of air quality in Class II wilderness areas, and minimizing deterioration of air quality in nonwilderness Class II areas (all remaining National Forest lands). The Salmon National Forest and the FC--RONRW are both Class II airsheds. The FC--RONRW was established by Congress in 1980 and has the potential to become a Class I airshed in the future.

The Regional Forester is the nondelegable Federal Land Manager (FLM) responsible to implement the 1977 Clean Air Act and State Air Quality Implementation Plans.

Forest Supervisor's responsibility is to take action to protect resources of the National Forest System lands from adverse impacts which may result from air pollution and atmospheric deposition.

Forest Service Manual 2120.43 and 2323.64 states the following policy is to be taken for Class I airsheds and Class II wildernesses:

1. Define Air Quality Related Values (AQRV's) and initiate action to protect those values.

2. For each AQRV, establish cost effective sensitive receptors for long term monitoring.

3. Recommend the Limit of Acceptable Change (LAC) for air quality sensitive receptors to the Federal Land Manager.

4. Monitor sensitive receptors to establish the limits of acceptable change needed to prevent adverse impacts to AQRV's.

5. Consult with local authorities on air pollution activities which impact National Forest resources.

6. Assist the Regional Air Quality Officer in determining the potential impacts of proposed facilities in coordination with State Air Quality Management agencies.

7. Make appropriate recommendations in the permitting process following established Prevention of Significant Deterioration (PSD) application review procedures for major emission sources.

8. Develop and integrate a Forest Air Resource Management Program into the Forest planning and budgeting process.

Management Direction

From 1931 to 1975 the FC--RONRW was managed as the Idaho Primitive Area. In 1980 it was designated under PL. 96-312 as the River of No Return Wilderness. In 1984 it was changed to the Frank Church--River Of No Return Wilderness. Approximately 18 percent (424,592 acres) of the FC--RONRW portion lies within the Salmon National Forest. The remainder lies within the Bitterroot (193,017 acres), Nezperce (110,075 acres), Boise (63,594 acres), Challis (782,225 acres), and the Payette (780,206 acres) National Forests. The FC--RONRW Management Plan objective is to maintain a wilderness where ecosystems are unaffected by man's manipulation, and plants and animals develop and respond to natural forces.

Air Quality

Objectives: Assure that air quality over the FC--RONRW is protected from pollution in excess of established standards.

1. Situation

Currently, the FC-RONRW and its associated Wild and Scenic Rivers are designated Class II. Present air quality is considered to be excellent, with perhaps 10 to 20 micrograms per cubic meter of total suspended particulates. The air quality related values of the area were evaluated in 1978, and redesignation to Class I was recommended.

Temporary and intermittent air pollution does occur, primary in the form of smoke from wildfires. Presently, this is considered to some degree both unavoidable and insignificant. In addition, smoke from the prescribed burning of logging slash outside the wilderness noticeably impacts visibility in the lower Salmon River Canyon and other places near the wilderness periphery. Even less significant are other pollution sources: sulfur dioxide emissions from jetboats on the Salmon River and aircraft at the wilderness airfields; smoke from campfires, administrative sites, and inholdings; dust from trail and road corridor traffic; dust, smoke and other emissions from mining activities.

There have been two new stationary sources subject to Prevention of Significant Deterioration (PSD) permit requirements in the vicinity of the wilderness in recent years. These are the Thompson Creek Mine, approximately 11 miles southeast of the wilderness; the Stibnite Mine, three miles west, their planned emissions as modeled are well within required standards, even if the wilderness were Class I.

The potential for more frequent large fires exist if fire management planning results in prescribed fires in the wilderness. This management option would increase smoke outputs over current levels in some years and even may exceed PM-10 increment. (Particles having a diameter of less than 10 micrometers). Potential ruling may exempt prescribed fires. Natural occurring fires (lightning caused) are "Nature in Action" and its effects upon "man", visibility and ordor are short term, such as; summer months only.

2. Assumptions

a. Air quality will remain high unless threatened by outside pollution sources.

b. Redesignation to Class I is desirable for long-range air quality protection.

3. Direction

a. Await State of Idaho action on Class I redesignation. Provide support, on request by State or Federal units of government, for redesignation.

b. Evaluate potential effects of proposed pollution sources for violation of Class II PSD standards.

c. Pending sampling data of actual baseline total suspended particles, 10 to 20 micrograms per cubic meter will be considered the norm in monitoring new pollution sources.

d. Await Class I redesignation before determining visibility standards and objectives. (The Salmon National Forest will not wait for a Class I redesignation, but will use the following baseline data of 5 percent reduction for visibility).

4. Monitoring, Coordination and Action Items

a. Monitor Air Quality Related Values that are affected by stationary sources outside of the wilderness to assure that emissions are within required standards.

b. Monitor visibility to determine baseline information.

Fire Management Plan- FC--RONRW

Objectives - General objectives of the plan

1. Permit lightning caused fires to play, as nearly as possible, their natural ecological role within wilderness.

2. Reduce, to an acceptable level, the risks and consequences of wildfire within wilderness or escaping from wilderness.

3. The use of fire as a means of restoring and perpetuating natural ecosystems within the wilderness.

4. Development of a program for using prescribed fire, which may include both planned and unplanned (natural) ignitions to achieve wilderness objectives.

5. Maintain cost effective prescribed fire and fire suppression programs within the wilderness.

6. Provide a smoke management program that reduces the impacts of residual smoke on air quality.

Air Quality

The impacts on air quality, both on site (within wilderness) and off site, must be closely evaluated in the initial management decision for a prescribed fire. This will require that managers understand Federal, State of Idaho, and State of Montana air quality laws and regulations. Managers must keep current on air quality situations which could affect their decision on prescribed fires. These off site effects could cause health problems for persons with chronic respiratory problems, impair fire detection, impair visibility, and impact airsheds to the point that other prescribed fire activities may be curtailed. The Salmon area is getting an increase in retired persons. This is also true for the Bitterroot Valley, north of Salmon in Montana, which lies in the Salmon National Forest smoke pattern at certain times of the year.

The closest Class 1 airshed to the Salmon National Forest is the "Anaconda-Pintler Wilderness." It is about 45 miles north of the town of Salmon and only about 12 miles north of the Salmon National Forest at Lost Trail Pass. Class 1 airsheds have the most stringent air standards of all wilderness. This means that the Salmon National Forest should monitor all emissions it produces into the atmosphere that have the potential to flow into the Anaconda-Pintler Wilderness. This is currently been accomplished during fire season.

The Prescribed Fire Smoke Management Guide (National Wildfire Coordinating Group (Draft) 1984, lists five considerations for managing smoke from long durations fires:

1. Develop contingency plans to limit smoke production if the need arises.

2. Establish and maintain close communication with state and local air quality groups regarding the status of such fires.

3 Monitor smoke plumes as appropriate to provide some advance warning of deteriorating air quality conditions.

4. Inform the general public of the status of such fires, including smoke management contingencies, through the local press, radio, and televisions.

5. Consider suppressing new fires when necessary for smoke management reasons, even though these fires may otherwise be in prescription.

The line officer (Forest Supervisor) will make a final decision on "Smoke Management Conditions" as to allow or not allow a fire to continue. A "Smoke Management Plan" is not just a single Forest concern, but should include several adjoining Forests, Statewide or even Northwest Regionwide. This is due to the fact that smoke emissions flow with the wind patterns, across State lines. Also, cummulative effects should be addressed in a "Smoke Management Plan." This plan should be coordinated at the Region Office level.

WILDERNESS MANAGEMENT PHILOSOPHY

The following thoughts should be considered when identifying sensitive receptors and limits of acceptable change:

1. All components of the wilderness resource are equally important.

2. A component of the wilderness resource is important even if the users of the wilderness are unaware of its existence.

3. The most sensitive components of the wilderness components are to be protected, not just those of "average" or "normal" sensitivity.

4. Each component of the wilderness resource is important for itself, as well as for how it interacts with other components of the ecosystem.

5. Components of the wilderness resource are to be protected from man-caused change rather than man-caused damage.

6. While it may not be possible to manage a wilderness in its natural or near natural state, each wilderness should be managed in as pristine a condition as the biological, physical, legal and political situation will allow.

PSD Permit Process

Permitting of air pollution sources under the PSD permitting program is a regulatory process that is subject to public hearings and potential judicial review. All information used to identify sensitive receptors and limits of acceptable change and all data collected in the wilderness monitoring plans must be reliable and accurate in order to meet public and judicial review.

PSD permit decisions are based on predictions of impacts of new or modified air pollution sources before the sources are constructed. The identification of sensitive receptors and limits of acceptable change must be based on the existence of appropriate predictive techniques. Without predictive techniques, it will be impossible to protect an identified sensitive receptor or limit of acceptable change.

Scientific Data

Selection of sensitive receptors and limits of acceptable change should consider scientific information available on the ability or inability of a receptor to resist and/or recover from man caused disturbance. Local information from the 1985 Acid Lake Survey water chemistry, and the 1988 Lichen

Survey is available to start some baseline data. Air emission information is available from within the State of Idaho and adjoining States (see appendix) at specific locations to aid in the corrulation of water chemistry and lichen survey. Long term monitoring of sensitive receptors, air chemistry and atmospheric deposition will be required to develop scientifically supportable decisions.

Public Involvement

The public should be involved with all phases of wilderness management. This is especially true for identifying limits of acceptable change. The Salmon National Forest is proposing to show to the public different photographs that show the difference in visibility reduction such as 5 to 10 percent, 10 to 20 percent or 20 to 30 percent loss, or more. This information will be used to adjust the baseline for visibility proposed at this time of 5 percent.

SALMON NATIONAL FOREST NON-WILDERNESS AIR RESOURCE POLICY

The Salmon National Forest Non-Wilderness Air Resource Policy is that the SNF will meet the 1977 Clean Air Act, the 1988 Idaho Air Quality Implementation Plan and all other Forest Service Policy Management directions.

IDENTIFICATION OF SENSITIVE RECEPTORS

AQRV's are general resource designations while sensitive receptors are the specific components of the system through which change will be quantified. The following sensitive receptors were selected on the following criteria:

1. Known or suspected sensitivity to atmospheric pollutants

2. Cost effective sampling and analysis methods

3. Availability of modeling capabilities for predicting the effects of proposed increase in emissions on the sensitive receptor

The AQRV's addressed in this plan are: Visibility, Water, Soils, Flora and Fauna.

Sensitive Receptors To Be Monitored:

Visibility

1. A automated camera site will be established at Middlefork Peak Lookout to aid in the determination of visual range and contrast.

Atmospheric Conditions To Be Monitored

1. Establish a particulate sampler on Baldy Mountain to monitor air chemistry and particle size.

Water

1. The water chemistry of Harbor, Golden Trout and Hat Creek Lakes.

2. Potential water chemistry of Iron, Wallace, Meadow, Reynolds, Yellowjacket and Corn Lakes.

3. Snowpack chemistry at proposed site along the Salmon River Mountain Road and other high elevation sites such as; Chief Joseph Pass and Gilmore Summit.

4. Rainfall water chemistry.

Soils

1. Soil surveys of Harbor, Golden Trout, Hat Creek and Meadow Lakes.

2. Potential soil surveys at Iron, Wallace, Reynolds, Yellowjacket and Corn Lakes.

Flora

1. Lichen communities at Harbor, Golden Trout, Hat Creek and Meadow Lakes, and Garden Creek.

2. Potential lichen communities at Iron, Wallace, Reynolds, Yellowjacket and Corn Lakes, and Horse Creek.

Fauna

1. Macroinvertebrate communities at Harbor, Golden Trout, and Hat Creek Lakes.

2. Potential macroinvertebrate communities Iron, Wallace, Reynolds, Meadow, Yellowjacket and Corn Lakes.

AIR QUALITY RELATED VALUES AND POTENTIAL AIR POLLUTION CHANGES

Air Quality Related Value	Potential Air Pollution Changes
1. Flora and Fauna	Growth, Mortality, Reproduction, Diversity, Visible Injury, Succession, Productivity
2. Soil	Cation Exchange Capacity, Base Saturation, pH, Structure, Metals Concentration
3. Water	Total Alkalinity, Metals Concentration, Other Toxics, Anion and Cation Concentration, pH, Dissolved Oxygen, Nutrients
4. Visibility	Contrast, Visual Range, Coloration

IDENTIFICATION OF EXISTING AND POTENTIAL AIR POLLUTION SOURCES

Sources of potential impacts and predicted deposition patterns are generally based on seasonal patterns of prevailing winds. Specific site predictions of air flow patterns carrying pollutants may be available through models such as TAPAS (Topographic Air Pollution Analysis System) developed for the Rocky Mountain Experiment Station in Fort Collins, or ARM 3; developed by the EPA.

Strong southwesterly winds prevail in this part of Idaho depending on the time of the year. At other times, the wind pattern flows from the west to northwest. The major sources of emissions that have the potential to affect this area are located in Boise, Idaho; Oregon and eastern Washington; wildfires within Idaho and the following states: California, Oregon, and Washington.

Air pollution from southern California or possibly the Salt Lake Valley in Utah may have the potential to affect this area depending on the wind patterns from the southeast.

A new potential source of emissions near the town of Salmon is the gold mine project by "Meridian Minerals Company" from Colorado. It will be located about 11 miles northwest of Salmon, over on the west side of the Salmon River Mountain road. The mine processing operation will consist of two open pits, waste rock disposal areas, heap leaching facilities, various haul and service roads, topsoil storage piles, ore crushing facilities, gold recovery facilities, and administrative and mine support facilities. The south pit will be approximately 500 to 1000 feet north of the historic town of Leesburg. The north pit will be about 1 mile north of Leesburg. This proposed mine site is about 13 miles east of the FC--RONRW boundary. The open pit mine will produce about 3.5 million tons of ore and about 7.0 million tons of waste rock. The initial forcast for the life of the mine is 7 years. The cyanide heap leaching facilities is designed to accommodate up to 25 million tons of ore over the life of the project on a single facility. The heap leach facility is estimated to be about 1500 feet west of Leesburg. Personnel needs are estimated between 100 to 150 people. Future operations are to mine approximately 35 million tons of sulfate ore which lies at a greater depth in the same deposit. Potential emissions are expected to be from diesel, dust, wood slash burning, cars, heavy equipment and wood stoves, crushing and digging operation and wind-soil erosion. If employees are not bused to the site by the mine, then there could be a minimum of 25 vehicles per day or more. Also, daily trucks which would be carrying fuel, chemicals, etc. This is in addition to any proposed timber sales in the Leesburg basin, Sawlog China road, Stormy Peak road, hunters, and firewood personnel. Currently, there are about 25 vehicles per day over the Naphis Creek and Stormy Peak roads. The end result is that there is the potential for a lot of traffic during the dry, dusty summer months. Air visibility from a safety standpoint may be a major concern during this time. There is at this time a monitoring program to establish baseline data. At this time it is a one-year program to sample PM-10 (particles having a diameter of less than 10 micrometers) and Total Suspended Particulates (TSP). Also, a metorlogical station is set up to determine wind speed and direction, precipitation and evaporation, temperature and relative humidity. The metorlogical station is proposed for the life of the project.

AIR QUALITY RELATED VALUES AND SENSITIVE RECEPTORS

The only Air Quality Related Value (AQRV) identified in the Clean Air Act is visibility. However, other Air Quality Related Values identified by the Forest Service are: flora, fauna, soil, water, odor, geologic and cultural features. Flora and fauna may be affected by changes in growth, mortality, reproduction, diversity, visible injury, succession and productivity. Soils may experience changes in cation exchange capacity, base saturation, pH, structure and metals concentrations. Water may change in pH, total alkalinity, metal concentrations, and anion/cation concentrations. Visibility contrast, visual range, and coloration may be affected. Cultural and archaeologic decomposition rates may change.

Air Quality Related Value sensitive receptors are those AQRV's that are measurably affected by changes in air quality. By monitoring these sensitive receptors, the Forest Service can detect impacts of changing air quality, estimate effects of proposed PSD sources, and use them as indicators of effects on nonmonitored AQRV's. Sensitive receptors are identified for each AQRV.

A. Visibility (Seasonal visual range, contrast and color baseline)

Visibility is a dominant and most detectable AQRV to many wilderness users and the general public. Visibility parameters include contrast, coloration, and visual range. Impairment to visibility involves atmospheric discoloration and reduction in visual range. Degradation of visual sight distances has occurred since the industrial development of the Western United States.

The scattering of light by air-borne particulate matter is the cause of visibility impairment. The coarse particles are dominated by the soil-derived elements (silicon, aluminum, calcium, iron, potassium, and titanium). The relative composition of these elements within an airshed is similar to that for the local soils. The fine particles play a much larger role in visibility impairment than do the coarse particles, since they include particles in the most efficient light scattering region of 0.2 to 1.0 micron. The major fine particle groups are ammonium sulfates, soil and soot. The remaining fine mass consist mostly of organic material, hydrocarbons and nitrates.

Visibility range can be quantitatively measured with teleradiometer readings or by the use of an automated camera system. Teleradiometers measure contrast between a view and a selected target. Automated camera systems provide photographs which can be digitized to characterize impacts of haze and plume. Criteria for selection of instrumentation sites should include accessibility, view of at least 20 miles, protection from vandalism, view of wilderness area, including a dark foreground with a sky background. Visibility is listed as Standard Visual Ranges (SVR). A 50 percent SVR value means that 50 percent of the time a person can see more than (x) km.

A automated visibility camera site was established atop Middlefork Peak lookout on the Salmon National Forest on July 8, 1989. This site is on the edge of the FC-RONRW, and will face southwest towards Big Baldy Mountain, about 30 miles from Middlefork Peak lookout, on the Boise National Forest, at an elevation of 9,722 feet. This site will be operated only during the time the lookout tower is occupied or until the first snowfall occurs. Standard visual range will be established over a five year period and used as a sensitive receptor.

Particulate data will be collected by means of using a nuclepore dichotomous stacked filter unit. Particulate data is essential for establishment of source-receptor relationships to help identify those existing pollutant sources whose emissions are impacting visibility and other AQRV's.

A particle sampling machine was installed atop of South Baldy Mountain, elevation 9,127 feet, approximately six air miles southwest of Salmon, Idaho, on July 1, 1989. Potential other particle sampling sites are at Middlefork Peak and Long Tom Lookouts. These sites would need solar cells for the power.

Identification of pollution sources can be made through elemental analyses. Some known source tracers include:

Particle Elements	Pollution Source
Lead plus bromine	- automotive
Vanadium and nickel	- combustion of fuel oil
Copper, zinc, arsenic, lead	- copper smelters
Fine potassium	- smoke from open fires
Selenium, sulfur, fine soil	- coal combustion
Potassium, chlorine	- potash industries
Zinc	- industrial, urban

B. Atmospheric Deposition

The three major processes effecting air pollutant compounds in the atmosphere include air transport, transformation and deposition. Air transport and dispersion of air-borne pollutants are controlled by windspeed, wind direction, atmospheric stability, thermal structure and topography. Sulfur dioxides, nitrogen oxides and chlorides are transformed by complex chemical reactions within the atmosphere to sulfuric, nitric and hydrochloric acids. After the pollutant material is transported and possibly chemically transformed, it is deposited either in the dry form (gases and fine particles) or in the wet form (rain, snow, ice and fog). Wet/Dry Deposition should be used as a sensitive receptor.

The primary source of wet deposition monitoring data in the United States is the National Trends Network (NTN). This weekly sampling network involves 150 station including many of the stations in the National Atmospheric Deposition Program (NADP). There are four NADP stations located in Idaho: Craters of the Moon in southern Idaho, Smith Ferry near Cascade, a site near Boise in Owyhee County, and one in Clearwater County in northern Idaho. In the adjoining states, sites are located at Logan, Utah, which may show potential emissions from the Salt Lake valley; western Wymoning, and eastern Washington. Region 1 is looking at the Lost Trail Pass area to establish a site to monitor air emissions coming into Montana. Data from these stations will be reviewed to see if there is any corralation between the Salmon National Forest lichen study results and air emissions. (See appendix for NADP site data).

Wet deposition monitoring involving collection of precipitation and analysis of acidity (pH) and the major inorganic chemical constituents should be identified as a primary sensitive receptor. The current NADP/NTN stations are primarily located at low elevation sites. Long term monitoring should be expanded to include the sensitive areas at high elevations.

Under sponsorship of the National Acid Precipitation Assessment Program (NAPAP), the US Environmental Protection Agency (EPA) has begun deploying the nation-wide National Dry Deposition Network (NDDN). The goal of NDDN is to estimate dry deposition fluxes and spatial and temporal trends of selected air pollutants throughout the United States. In addition, wet deposition samples will be collected and analyzed at the NDDN sites. The goal is to have a nation-wide network of 100 stations deployed by the end of FY-89. Future funding and the need to gather more detailed air emissions for this area may require a site on the Salmon National Forest at a high elevation site.

Eighty percent of the annual precipitation within the Salmon National Forest received in the form of snow. Snowpack can be sampled throughout the season to determine what amount of atmospheric deposition has taken place. This is especially important due to the concern of concentrating acid deposition throughout the ecosystem during spring snowmelt. The Forest Service will collect one snow core sample from sites along the Salmon River Mountain Road, located in the Salmon River Mountains starting in 1990, depending on future funding. These samples will be analyzed by a private laboratory in Idaho. Potential snow pack chemistry sites are located at Gilmore Summit and Chief Joseph Pass.

C. Water

The Salmon National Forest contains over 321 lakes, 89 named and 232 unnamed lakes including numerous ponds located in glacial basins. Many of the lakes support grayling, golden, rainbow and cutthroat fisheries. Most of the natural lakes and ponds are found at elevations above 8,000 feet. The geology of the watershed above the lakes consist primarily of Precambrian quartzites and granites.

In 1984 the Forest Service, EPA and USGS conducted the Western Pilot Study, prior to the initiation of the 1985 Western Lake Survey. Six lakes were selected on the basis of accessibility and probable sensitivity to acid deposition. Results described that four lakes sampled as "sensitive" because acid neutralizing capacity (ANC) were less than 200 microequivalents per liter (ueq/l). These are: Skyhigh, Harbor, Golden Trout and Hat Creek Lakes. One of the sensitive lakes were designated as "very sensitive" with ANC's between 70-100 ueq/l. Three of the lakes were designated "ultra-sensitive" with ANC's less than 75 ueq/l. (Harbor, Golden Trout and Hat Creek Lakes). (See appendix for EPA data results).

Studies in Europe, Canada and the United States show that lakes with alkalinities of 50 microequivalents or less are considered extremely sensitive to acidic depostion. Bedrock types, elevation and sampling methodologies add to variation of results.

The 1985 Western Lake Survey sampled six lakes located in the Salmon River Mountains. These lakes were selected randomly as part of the 888 lakes sampled throughout the Western United States.

The extremely low acid neutralizing capacity of the lake water indicates that the aquatic ecosystems may have little buffering capacity for protection from acid deposition.

A major concern for the lake ecosystems is possible "acid shock" during snowmelt. Acid material in the snow causes a freezing point depression which can result in the hydrogen ion concentration of the first melt water, being five to ten times that of the bulk snowmelt. It is possible that the first snowmelt would have little to no interaction with the frozen soils before it enters the lake systems. As a result, the lake chemistry may end up being the same as the initial snowmelt chemistry for a short time period.

The long-term effect of acidic deposition upon the ability of a watershed to continue to generate buffering capacity is a major AQRV concern. Measurements of water chemistry including acid neutralizing capacity should reflect changes from acid deposition and should be considered a primary sensitive receptor.

Lake Water Chemistry

Continue water chemistry sampling at Harbor, Golden Trout and Hat Creek Lakes. These lakes have been identified as very sensitive to acid deposition due to low alkalinities. The EPA and Forest Service monitoring program started in 1985 has begun to provide baseline information. Future water chemistry sampling will be taken at Iron, Wallace, Yellowjacket, Reynolds, Meadow and Corn Lake. The following data will be analysed: pH, and Alkalinity. Future data may consist of Specific Conductance, DOC, Chorophyll-a, Al-total, Al-dissolved, Ca, C1, F, K, Mg, Na, Si, PO4, SO4, NH4, NO3, S isotopes, Zn, Pb, Cd, Cu, Fe, Cd.

Rainfall Water Chemistry

Spring and summer rains produce an unknown amount of anion and cations on to the Salmon National Forest lands. This is usually from storm patterns which generate either off the coast of Oregon or Washington and California. The jet stream which is generally a dry air mass flows over Idaho between 20,000 to 40, 000 feet. This jet stream may also bring moisture from off the coast. The collection of rainfall during July 1989 showed minor amounts of very fine sand particles that were trapped by the rainfall droplets. It appears that these sand particles could have been transported from the west or southwest dry deserts. The action producing this is probably a large dust whirlewind that transported soil particles up to 10,000 or 20,000 feet, such as large Cumulas clouds, building over the deserts. The northeast to eastward winds then transported this material and clouds towards Idaho. When they reach the mountains of Idaho, they sometimes produce rain, that also deposits some soil particles. The rain that is produced is usually between about 10,000 and 18,000 feet. The clouds are generally above the Continental Divide which is around 10,000 feet.

The rainfall water chemistry analysis will determe the amounts of: calcium, magnesium, potassium, sodium, ammonia as nitrogen, nitrate as nitrogen, chloride, sulfate and pH. The pH and ammonia nitrate break down the fastest and are affected by the biological activity within the wet sample. The oxidation of nitrite and sulfites will result in increased concentrations. Refrigeration at 39 degrees F. will minimize, but not eliminate concentration changes. Through express mail, a sample from Salmon to the Boise laboratory is

less than 24 hours. Total time from collection to laboratory is about 40 hours.

Snowpack Chemistry

Snowpack chemistry indicates the winter accumulation of atmospheric deposition. The ion content of a snow pack remains relatively stable prior to initial snowmelt. Generally, the first spring snowmelt water contains at least fifty percent of the acid material in the snow pack. Potential snow pack chemistry sites are located along the Salmon River Mountain Road located in the Salmon River Mountains, Chief Joseph Pass, and Gilmore Summit. Hydrologic graphs of the Panther Creek drainage will be utilized to help determine the approximate snowmelt timeframe for the Salmon River Mountain areas. Some background data for chemical constituents has been collected on the Montana side of the Beaverhead Mountains that adjoin the Salmon National Forest on the east. Seventy-seven snow samples were collected during the winter of 1982 and analyzed. The sites that are near the SNF are; Saddle Mountain and Gibbons Pass near Lost Trail Pass, Lost Trail Pass, Bloody Dick near Goldstone Pass, and Bannock Pass. The following snow analysis data is from these above sites:

Code	Location	Lab pH	S.C. umhos/cm	Na	K	Mg2	Ca2	NO3	SO4	Cl	NH4
						ueq/l					
SP 112	Saddle Mtn.	5.30	5.00	1	--	1	5	.8	--	1	1
SP 113	Gibbons Pass	5.50	2.75	3	--	.2	10	-	ND	3	-
SP 121	Bloody Dick	5.59	3.59	9	--	2	10	34	4	2	1
SP 122	Bloody Dick Pillow	5.46	6.85	9	--	3	20	11	3	9	1
SP 133	Bannock Pass 0-3 inches	5.52	3.21	44	--	2	10	25	4	39	11
SP 135	Bannock Pass 3-6 inches	5.41	7.38	9	--	15	70	27	5	330	39
SP 150	Bannock Pass 6-9 inches	5.48	7.17	27	8	4	10	19	3	120	22
SP 142	Bannock Pass 9-12 inches	5.49	7.17	9	--	-	10	10	7	6	2
SP 151	Bannock Pass 12-18 inches	5.38	4.89	38	10	12	47	26	7	230	23
SP 134	Bannock Pass 18-24 inches	5.34	14.10	57	--	4	20	11	4	42	13
SP 152	Bannock Pass 24-30 inches	5.48	7.07	20	25	35	110	54	33	560	62
SP 148	Bannock Pass 30inches-bottom	5.24	81.00	35	100	6	85	21	8	16	5
SP 166	Lost Trail Pass 0- 2 inches	------------ SAMPLE CONTAMINATED --------------------									
SP 158	Lost Trail Pass 4/5inch-12inches	5.39	4.77	9	--	7	29	9	6	110	11
SP 129	Lost Trail Pass 12-18inches	5.38	7.67	3	--	3	10	7	-	18	4
SP 163	Lost Trail Pass 18-24inches	5.51	3.22	27	3	16	60	26	4	200	20
SP 159	Lost Trail Pass 24-30inches	5.31	5.44	10	--	9	36	44	8	270	23

SP 169 Lost Trail Pass										
30-36inches	5.38	3.52	34	8	11	75	32	10	410	41
SP 157 Lost Trail Pass										
36-42inches	5.41	22.60	9	--	2	10	8	2	13	4
SP 162 Lost Trail Pass										
42-48inches	5.51	4.55	22	5	33	100	56	6	280	30
SP 160 Lost Trail Pass										
48inches-bottom	4.47	51.90	20	17	17	55	53	-	170	47

The above snow chemistry data and the following information is quoted from the report "Chemistry Of Montana Snow Precipitation, 1982", by Gordon K. Pagenkopf, Department of Chemistry, Montana State University, Bozeman, Montana. "During the winter of 1980-81 southern Montana received sizeable quantities of snow that was found to be more acidic than background. Studies carried out during 1982 did not indicate any sizeable amount of acid deposition in snow samples taken from this same area. Several reasons may account for this. The most likely is the amount of snowfall during the two years. During 1980-81 the snowfall was below normal and thus it is possible that received acid deposition was more concentrated. During 1981-82 snowfall was above normal and could act to dilute the acid deposition and provide pH values in the normal range. The main sources of acid oxides that could reach western Montana appears to be the Seattle-Tacoma area of Washington, the Portland area of Oregon, the San Francisco Bay area, the greater Los Angeles basin and the Wasatch front in Utah. With more rain and snowfall during 1981-82 the transport of the acid oxides was probably reduced and thus less material reached western Montana".

D. Aquatic Life (Macroinvertebrates)

Biotic impacts to lake ecosystems caused by pH change include changes in reproduction, growth, mortality and species diversity of phytoplankton, zooplankton, macroinvertebrates and fish. Phytoplankton, zooplankton and macroinvertebrates (major fish foods) are impacted at higher pH levels than fish, therefore, they may be better sensitive receptors.

Over 102 lakes in the Salmon National Forest have been stocked with rainbow, cutthroat, and cutthrout rainbow cross. Golden trout and arctic grayling have also been stocked in certain localities. Approximately 59 lakes within the Salmon National Forest portion of the FC--RONRW have been stocked. All six lakes sampled during the Western Lake Survey, are known to maintain populations of fish.

The ultraoligotrophic lakes characteristic of sensitive areas harbor ecosystems which are unique. These ecosystems may be damaged by levels of acidification (pH <6.5) that may not affect fish at all. Acidic water reduces the bacterial decomposition of debris. Amphipods cannot tolerate pH below 6.0. Many species of stoneflies (Plecoptera), mayflies (Ephemeroptera), and caddisflies die at pH less than 5.0.

Species diversity of phytoplankton, zooplankton, diatoms, and macroinvertebrates are determined by water quality characteristics. Since these biological indicators are always present within the aquatic ecosystem they have a tendency to react to year round water quality conditions. Quantitative analyses of these biological aquatic sensitive receptors should be conducted. Macroinvertebrate sampling of Harbor Lake and Hat Creek Lake (SE)

was accomplished in 1988. Golden Trout, Harbor and Hat Creek Lakes will be sampled in 1989.

E. Soils

The consequences of chemical inputs to soils vary greatly, depending upon the rates, the character of the vegetation, and the physical and chemical properties of the soil. The soils of Hat Creek and Harbor Lakes may have very low buffering capacity due to the quartzite parent material and granitics respectialy.

Both dry and wet deposition may affect the soils by changing:

1. Cation exchange capacity
2. Leaching rates of plant nutrients
3. Rates of microbial processes, e.g., nitrogen fixation
4. Decay rates of Forest floor materials
5. Availability of phosphorus to plants
6. Solubility of elements toxic to plants
7. pH
8. Sulfate absorption capacity

F. Fauna

Terrestrial fauna have been identified on the Salmon National Forest and all species are thought to be relatively insensitive to the potential air pollutants.

G. Flora

Acid deposition may affect young plant growing tissues and the process of photosynthesis. Plants require their embryonic tissues throughout their lives for the formation of new leaves and buds. When tissues are damaged, a plant's developmental power is diminished, gross deformations occur, vitality is sapped, and chances for survival are lessened. Chlorophyll becomes bleached when exposed to low pH values, prohibiting the photosynthesis process.

Lichens, a symbiotic association between algae and fungi, are possibly the plant group most sensitive to air pollution. Lichens have no root system and receive all their nutrients and moisture from the atmosphere. They have no excretion systems and as a result may concentrate both beneficial and phytotoxic materials. Gases such as sulfur dioxide, when dissolved in water, will attack the algae symbiont in the thallus resulting in chlorosis, phaeophytin formation or plasmolysis. Such injury can result in death.

The lichen community of the FC-RONRW portion of the Salmon National Forest and the nonportion is identified as a sensitive receptor to atmospheric deposition. It has been proven that lichens are very sensitive and can serve as monitors of air pollution. Many physiological and structural factors contribute to this susceptibility: 1) lichens have no protective cuticle to protect from atmosphere, 2) they absorb most of their nutrients and water directly from the atmosphere, 3) they have high retention capacity and therefore accumulate elements, 4) they are long lived.

Dr. Larry St. Clair, Department of Botany and Range, Brigham Young University conducted a reconnaissance lichen survey on the Salmon National Forest in August 1988. Lichen samples were collected near Hat Creek Lake, Harbor Lake, Golden Trout Lake and the lower end of Garden Creek, off of lower Panther Creek. Thallus content for Pb, S, and Cu will be determined using atomic absorption spectrophotometry and barium chloride. Potential future sites are: Meadow, Iron, Wallace, Yellowjacket, Reynolds and Corn Lakes. Lower Horse Creek may serve as a potential river corridor site from winds that flow from the west.

Lichens have been used as bioindicators to determine severity and extent of air pollution around numerous pollution sources. The varying sensitivity of different lichen species to air pollution and their long life span (100+ years) make them an ideal bioindicator and sensitive receptor for this study.

The following information was taken directly from the report by the Environmental Protection Agency, " National Air Quality and Emissions Trends Report, 1987." EPA-450-4-89-001, March 1989.

"Nationally, sulfur oxide emissions decreased 17 percent from 1978 to 1987, reflecting the installation of flue gas desulfurization controls at coal-fired electric generating stations and reduction in the average sulfur content of fuels consumed. Emissions from industrial processes have declined, primarily as the result of controls implemented to reduce emissions from nonferrous smelters and sulfuric acid manufacturing plants. Sites included are large power plants, nonferrous smelters, paper mills and steel producing facilities. Two-thirds of all national sulfur dioxide emissions are generated by electric utilities (96 percent from coal fired power plants). From 1983 to 1987 the 5 year trend shows a 10 percent decline in average concentrations, indicating that the long term trend has continued, but has been leveling off. Between 1986 and 1987, average ambient concentrations have declined 3 percent, corresponding to a 1 percent decrease in total emissions."

"Lead gasoline additives, nonferrous smelters and battery plants are the most significant contributors to atmospheric lead emissions. Transportation sources in 1987 contributed 37 percent of the annual emissions, down substantially from 73 percent in 1985. The lead content of leaded gasoline was reduced from an average of 1.0 grams per gallon to 0.5 grams per gallon in July 1, 1985 and still futher to 0.1 grams per gallon on January 1, 1986. In 1975 unleaded gasoline was introduced for automobile equipped with catalytic control devices. These devices reduced emissions of carbon monoxide, volatile organics and nitrogen oxides. In 1987 unleaded gasoline sales accounted for 76 percent of the total gasoline market. Lead emissions from industrial sources have dropped by more than 1/2 from levels reported in the late 70s. Emissions of lead from solid waste disposal are down 35 percent since late 70s. In 1987 emissions from solid waste disposal represent the second largest category of lead emissions. The 1978-87 drop in total lead emissions was 94 percent. This compares with a 88 percent decrease (1978-87) in ambient lead."

MONITORING ACTION PLAN

A. Visibility

1. Visibility Camera

An automated Camera Visibility Monitoring Site, is located on Middlefork Peak Lookout (9,127 feet in elevation) on the Cobalt Ranger District of the Salmon National Forest and will become operational during July 1989. The visibility target is Big Baldy Mountain, located about 30 miles away within the FC-RONRW on the Boise National Forest. The objective is to establish baseline visual record of visibility events and quantitative standard visual range for the airshed within the wilderness. Baseline data will be established by operating the camera site for at least five years. Proposed LAC baseline will allow only a 5 percent decrease in visibility.

2. Particulate Sampler

A Particulate Sampler has been installed on South Baldy Mountain, (9,149 feet elevation), about six air miles southwest of Salmon and about 21 air miles east of the FC-RONRW. This is the only one of two high mountain sites with year round access and 120 volt power.

This particulate sampler was installed on July 1, 1989. It will have an automatic timer to record every Wednesday and Saturday for the months of July, August, September and October. Filters will be collected twice a week and sent to the University of California at Davis for lab analysis. This particle sampler will become part of the nation-wide system with 35 to 40 other sites. Baseline data will be collected for five years.

ATMOSPHERIC DEPOSITION

B. Snow Core Sampling

Snow core samples will be collected by the Forest Service along the Salmon River Mountain Road within the Salmon National Forest. Potential sites would be at high elevations that can be accessed by vehicle such as Chief Joseph Pass, and Gilmore Summit. A private laboratory will conduct the chemical analysis. Starting in 1990, samples will be collected, during maximum accumulation, and before snow melt, depending on future funding.

Potential Snowcore Sites	Section	Township	Range	Elevation
Salmon River Mt. Rd.	10,15,27	20N	20E	8000 to 9000 feet
Chief Joseph Pass	11	27N	21E	7264 feet
Gilmore Summit	27, 28	13N	27E	7198 feet

Wet/Dry Deposition

Pursue establishment through cooperative monitoring of both Wet and Dry Deposition sites. The Forest Service would be willing to operate and maintain sites if cooperators can be found who will provide equipment and laboratory analysis.

Criteria for NADP wet deposition type sites and NDDP dry deposition type sites include weekly year round access for operation and maintenance and 120 volt electric power for site operation. Recommended site is Baldy Mountain located in the Salmon River Mountains on the Salmon National Forest. This will depend on future funding and the need to gather more precise data for this area.

Potential Deposition Sites	Elevation	Winter Access	Power Source
Baldy Mountain	9,149	Snowmobile	120 volts

C. Water

1. Indicator lakes will become the foundation for a long term monitoring program to quantify future changes in the chemistry and biology of aquatic ecosystems. Criteria for lake selection for long term monitoring included acid neutralizing capacity (ANC) less than 75 ueq/L, small affected watershed area, low watershed-to-lake volume ratio, aquatic species diversity, and reasonable access.

Field data will be collected to include ALK, pH, soil pH and geologic material classification. Lab data consisted of pH and Alk determination. The field method for determination of pH will be the phenol-red indicator technique. Alk will be determined in the field by titration to the bromocresol green-methyl endpoint. Lab determinations of pH will be made with a calibrated pH meter and combination pH electrode. Alkalinity water samples will be sent to the State of Idaho water lab in Boise for analysis.

Three "ultra-sensitive" indicator lakes, on the Salmon National Forest, have been selected for long term monitoring starting in 1989. The lakes will be sampled twice a year, for five years, once in the spring immediately after snowmelt and once in the fall after mixing. Deep snow drifts may prevent early spring sampling. Harbor Lake and Golden Trout Lake are located within the FC-RONRW and accessed by the Crags campground trailheads. Hat Creek Lake is located outside the FC-RONRW and is accessed from the Iron Lake Road. These three lakes were sampled in 1985 during the Western Lake Survey. These three lakes will be monitored for a period of five years to establish baseline data.

ID. NO.	NAME	LATITUDE	LONGITUDE	ANC (ueq/L)	ELEV. (feet)	DEPTH (meter)	WILDERNESS
4C3-042	Hat Creek Lake	44-52'39"	114-12'14"	35.0	8809	6.4	No
4C2-035	Harbor Lake	45-08'35"	114-35'30"	41.6	8928	11.0	Yes
4C2-036	Golden Trout Lake	45-06'40"	114-31'15	75.1	8153	19.5	Yes

The above three lakes sampled within the Salmon River Mountains during the 1985 surveys were classified as "ultra-sensitive" to acid deposition based on acid

neutralizing capacity less than 75 ueq/L. In addition to the three indicator lakes, the following lakes are recommended for possible future and/or cooperative monitoring.

ID. NO.	NAME	LATITUDE	LONGITUDE	ANC (ueq L)	ELEV. (feet)	DEPTH (meter)	WILDERNESS AND FOREST
	Reynolds Lake	45-33'20"	114-32'45"		7000		Yes/Salmon
	Meadow Lake	44-26'00"	113-19'00"		9000		No/Salmon
	Wallace Lake	45-14'45"	114-00'10"		8200		No/Salmon
	Iron Lake	45-54'20"	114-11'40"		8506		No/Salmon
	Yellowjacket L.	45-04'00	114-33'00"		8000		No/Salmon
	Corn Lake	45-23'30	114-27'00		7829		No/Salmon

2. The Salmon National Forest will evaluate these lakes during the summer of 1989 and 1990 as potential indicator lakes. In addition to lakes sampled in 1985, new "ultra-sensitive" lakes with better access may be selected.

3. Collect rainfall from summer high intensity storms to determine its chemistry and to compare it to NADP sites. This may help determine if there are any emissions from outside Idaho such as California, Oregon, Washington or Utah that have potential effect on our resources. Proposed collection sites are Middlefork Peak, South Baldy Mountain and Perreau Creek. Samples will be sent to a laboratory in Boise, Idaho for analysis.

The following data was collected during July 1989.

July 16, 1989/ wind direction from the south during forest fires burning in Utah.

July 23, 1989/ wind direction from west. Jet stream from Oregon.

July 26, 1989/ wind from southwest. Jet stream from Central California and possibly Southern California.

(Chemistry analysis is mg/l, (1 mg/l = 1 ppm)

Analysis	7/16	7/23	7/26
pH (SU)	4.95	5.40	4.53
Chloride	1.23	0.40	2.42
Nitrate as N	0.35	0.29	0.81
Sulfate	1.03	0.79	3.10
Ammonia as N	0.34	0.14	1.18
Calcium	0.49	0.72	1.12
Magnesium	0.19	0.09	0.21
Potassium	0.78	0.42	0.40
Sodium	0.44	0.20	0.36

This preliminary data shows that the jet stream winds from central and southern California have a direct effect and influence on the Salmon National Forest in respect to lower pH, and higher chloride, Nitrate as N, sulfate, Ammonia as N,

calcium and magnesium. The high potassium on July 16, maybe related to the fires burning in Utah.

4. Seek cooperative long-term monitoring with EPA on WLS-Phase III lakes.

5. Direct research and other acid deposition monitoring activities such as soils, lichens, macroinvertebrate, etc., toward the watersheds of the selected indicator lakes.

6. The potential LAC for Lake Alkalinity will be 0.10 pH unit change.

D. Aquatic Life

1. Macroinvertebrates will be sampled twice a year, spring and fall, at the inlet or outlet of Harbor Lake, Golden Trout Lake and Hat Creek Lake. These lakes will be sampled and monitored for a period of five years to establish baseline data. Deep snow drifts may prevent early spring sampling.

2. Future potential macroinvertebrate sites are: Meadow, Reynolds, Wallace, Iron, Yellowjacket and Corn lakes. These lakes will be sampled starting in 1989 or 1990.

E. Soils

1. An Order I Soil Survey for the Harbor, Golden Trout, Hat Creek Lake watershed above the lakes will be conducted by the Salmon Forest Soil Scientist during the summer of 1989 or 1990. Potential Order 1 Soil Surveys for Wallace, Reynolds, Meadow, Iron and Corn Lakes will be considered.

2. Samples from each major soil horizon will be analyzed for pH, cation exchange capacity, exchangeable bases, exchange acidity, organic matter, texture and sulfate absorption capacity.

3. Encourage research on the effects of acid deposition and soil buffering capacity on indicator watersheds at high elevation lakes in the Salmon National Forest.

4. The potential LAC for sulfate deposition will be 5 Kg per acre.

F. Flora

1. Dr. Larry St. Clair, Department of Botany and Range, Brigham Young University, conducted a reconnaissance lichen survey on the Salmon National Forest in August 1988. Lichen samples were collected near Harbor Lake, Golden Trout Lake, Hat Creek Lake and Lower Garden Garden Creek. Thallus content for lead, and copper were determined using atomic absorption spectrophotometry and sulfur was assessed turbidimetrically using barium chloride.

Preliminary lab data from lichens collected August 1988:

Location	Copper	Lead	Sulfur
Golden Trout Lake	7-9 ppm	6-9 pppm	.01-.14%

Harbor Lake	5-6 ppm	10-12 ppm	.05-.13%
Hat Creek Lake	3 ppm	8-11 ppm	.04-.08%
Garden Creek	4-6 ppm	5-10 ppm	.01-.08%

Preliminary Species of Lichens

Lecidea atrobrunnea	Harbor Lake
Solorina crocea	Harbor Lake
Aspicilia caesiocinerea	Golden Trout Lake
Hypogymnia imshaugii	Golden Trout Lake
Lecanora varia	Golden Trout Lake
Lepraria arctica	Golden Trout Lake
Letharia columbiana	Golden Trout Lake
Letharia vulpina	Golden Trout Lake
Melanelia exasperatula	Golden Trout Lake
Porpidia macrocarpa	Golden Trout Lake
Rhizoplaca melanophthalma	Golden Trout Lake
Bellemeria alpina	Hat Creek Lake
Bryoria lanestris	Hat Creek Lake
Lecanora frustulosa	Hat Creek Lake
Lecanora polytropa	Hat Creek Lake
Lecanora thomsonii	Hat Creek Lake
Lecidea berengeriana	Hat Creek Lake
Lecidea tessellata	Hat Creek Lake
Pseudephebe minuscula	Hat Creek Lake
Pseudephebe pubescens	Hat Creek Lake
Sporastatia testudinea	Hat Creek Lake
Umbilicaria hyperborea	Hat Creek Lake
Umbilicaria krascheninnikovii	Hat Creek Lake
Acarospora chlorophana	Garden Creek
Caloplaca epithallina	Garden Creek
Catillaria glauconigra	Garden Creek
Catapyrenium lachneum	Garden Creek
Dermatocarpon miniatum	Garden Creek
Dermatocarpon moulinsii	Garden Creek
Dimelaena oreina	Garden Creek
Diploschistes scruposus	Garden Creek
Lecanora rupicola	Garden Creek
Rhizoplaca chrysoleuca	Garden Creek
Umbilicaria vellea	Garden Creek
Usnea lapponica	Garden Creek
Xanthoparmelia cumberlandia	Garden Creek
Xanthoparmelia plittii	Garden Creek
Xanthoparmelia taractica	Garden Creek
Xanthoria elegans	Garden Creek
Xanthoria fallax	Garden Creek

This above data shows that the Salmon National Forest contains one of the "CLEANEST AIR" locations between the Salmon National Forest and Utah according to Dr. Larry St. Clair.

2. Lichen samples will be collected at lower Horse Creek, Wallace, Reynolds, Iron, Yellowjacket and Meadow Lakes during the summer of 1990.

Laboratory analysis as listed in Item 1 above, will be determined for future reference. Wallace, Iron, Meadow and Yellowjacket and Corn Lakes are recreation sites that allow motor vehicle traffic.

Baseline data may be required at these sites for potential recreation use increase over the next 10 to 30 years or more.

3. Plant community types will be inventoried within the indicator watersheds. Sensitive flora species will be identified and monitored as secondary receptors.

4. Lichen samples will be collected from selected sites according to past lab data. Elemental analysis will be monitored every five years, permanent plot photographs every five years and floristic inventory every ten years.

LIMITS OF ACCEPTABLE CHANGE

The limits of acceptable change (LACS) are those changes in chemical, physical, biological and/or social conditions of a wilderness component that can occur without a loss of wilderness character. Generally, the LAC's are the standards that the Forest Service uses to determine if monitored or predicted air pollution causes changes are acceptable.

The identification of limits of acceptable change is a management decision based on:

1. Management goals and objectives identified in the 1964 Wilderness Act and subsequent regulations (36 CFR 293)

2. Agency, Regional and Forest management goals and objectives identified in the Forest Service Manual, Regional Guides and Forest Plans.

3. The air regulatory process identified in Federal and State Prevention of Significant Deterioration (PSD) regulations

4. The existing condition and sensitivity of specific wilderness components.

5. The existing or potential state of science related to understanding, monitoring and predicting air pollution caused changes.

6. Public input

A proposed limit of acceptable change, to start as a baseline until more data is obtained has been identified as a 20 percent change in alkalinity. A 0.1 pH change will be used for lake alkalinity, a 5kg/acre deposited sulfate on the soil and a 5 percent decrease in visibility.. Other LAC's may be added at a later date from research reports.

IMPLEMENTATION COST

The Chief of the Forest Service has given direction that air will be recognized as a basic resource which will be given the same management emphasis as all other Forest resources. National funding levels approved by the Chief and staff for the next two years include $3.7 million in FY 1989, and $5.2 million in FY 1990. Region 4 expects to receive about $500,000 in FY 1990.

The Salmon National Forest ranked eleventh in air resource management workload of the sixteen National Forests within the Region. The Regional Office recommended 1990 air resource program funding for the Salmon National Forest is $15,200.

The following table estimates implementation costs outlined in the Salmon National Forest including portions of the Frank Church--River Of No Return Wilderness AQRV Action Plan.

SALMON NATIONAL FOREST ACTIVITIES	COST ($) 1989	1990	1991	1992	1993
Middlefork Peak Visibility Camera	$4.3	$2.2	$2.2	$2.2	$2.2
Particulate Sampler	2.5	2.0	6.3	6.3	6.3
Snow Core Sampling	-	0.6	0.6	0.6	0.6
Water Chemistry (lake)	0.4	0.1	0.1	0.1	0.1
Water Chemistry (rainfall)	0.4	0.6	0.6	0.6	0.6
Macroinvertebrate Sampling	0.1	1.2	0.3	0.3	0.3
Order I Soil Survey	-	1.0	1.0	0.5	0.5
Lichen Studies	-	2.5	0.5	-	2.5
Totals	7.7	10.2	11.6	10.1	12.6

DOCUMENTATION

Master copies of the Salmon National Forest including portions of the Frank Church--River Of No Return Wilderness Air Quality Related Value Program will be kept on file at the Supervisor's Offices on the Salmon National Forest in Salmon, Idaho.

Development of detailed monitoring plans, preparation of reports, and updating the bibliography will be a continuous process. Documentation of the AQRV program will consist of different sections, bound in a three-ring notebook, allowing additions as the project proceeds. Section I, will consist of the Salmon National Forest including portions of the Frank Church--River Of No Return Wilderness AQRV Action Plan. Section II, will contain detailed monitoring and quality plans. Section III, will consist of individual reports including documentation and analysis of monitoring data. Section IV, will contain a bibliography list of associated and/or pertinent reports and articles. Additional sections may be added as needed.

Documentation of the Salmon National Forest including portions of the Frank Church--River Of No Return Wilderness Air Quality Related Value Program notebook will be updated once a year. Additional monitoring plans, data documentation, or completed reports will be added to the appropriate sections. The table of contents will reflect any additional reports to the program.

COORDINATION

Cooperation with Federal, State, local agencies, private and public organizations is an important part for a successful AQRV program. The following are current contacts.

Name and Address	Work Studies
Bureau of Air Quality Division of Environmental Health Idaho Department of Health ATTN: John Ledger Boise, ID 83720 208-334-5898	Lead air quality agency for the State Chris Johnson- air quality specialist and metorlogist
Bureau of Water Pollution Control Idaho Department of Health Boise, ID 83720	State water quality management coordinates chemical analysis of water and snow core samples
State of Idaho Air Quality Control Division of Environmental Health ATTN: Audrey Cole Pocatello, ID 83201 208-236-6160	Air Resource Coordinator for Southeast Idaho
Dr. Larry St. Clair Department of Botany and Range Science Brigham Young University 401 W1DB Provo, UT 84602 801-378-2582	Lichen studies
USDA-Soil Conservation Service Idaho Snow Survey Jerry Beard Boise, ID 83705	Collects snow core samples for chemical analysis
Idaho State Laboratory Jim Dodds Boise, ID 83706 208-334-2235	Conducts chemical analysis of snow core samples
US Enviromental Protection Agency Region 8 Denver Federal Center P.O. Box 25366 Lakewood, CO 80225	1984 Western Pilot Study 1985 Western Lake Survey
US Geological Survey National Water Quality Laboratory 5293 Ward Road Arvada, CO 80002	Conducts chemical water analysis on lake and deposition samples

US Geological Survey
Water Resource Division
1745 West 1700 South
Salt Lake City, UT 84401
801-534-4249

1984 Western Pilot Study

US Geological Survey
Water Resource Division
ATTN: John Turk
Bldg. 53 Mail Stop 415
Denver Federal Center
Lakewood, Colorado 80225
303-236-4886

Water Chemistry

US Enviromental Protection Agency
Environmental Monitoring Systems Laboratory
ATTN: Steven M. Bromberg
Research Triangle Park
North Carolina 27711

US Enviromental Protection Agency
Environmental Service Division
ATTN: Denise Link
8ES-Es
Denver Federal Center
P. O. Box 25366
Lakewood, CO 80225

State of Montana
Deparment of Health
Air Quality Bureau
ATTN: Stan Sternberg
Helena, MT 59620
406-444-3454

U.S. Forest Service
Intermountain Fire Science Laboratory
ATTN: Darold Ward and Bob Ekblad
P. O. Box 8089
Missoula, MT 59807
406-329-4820

Air Resource Specialists Inc.
ATTN: John Faust
1901 Sharp Point Dr., Suite E
Ft. Collins, CO 80525
303-484-7941

USFS Visibility Contractor

USDA-Forest Service Rocky Mountain Forest and Range Expermental Station ATTN: Rich Fisher 240 West Prospect Street Fort Collins, CO 80526 303-498-1232	1. Air Resource Contact for W.O. 2. Ann Acheson - writer for the "Bob Marshall Wilderness AQRV Plan" 3. Doug Fox - Project Leader for Air Quality Projects and Chief Metorlogist 4. Dick Summerfield - Geochemist for Snow Chemistry 303-498-1233 5. Dr. Frank Vertucci- Limnologist and Snow Chemistry
Colorado State University ATTN: Carol Simmons Denver, CO 80210 303-491-1978	Coordinator for NADP NADD print outs from: Gwen Scott (303)-491-1465
USDA-Forest Service Gallatin National Forest ATTN: Mark Story Federal Bldg. Box 130 Bozeman, MT 59771 406-587-6701	Air Quality Coordinator for establishing NADP and Snow Core Survey's with Sula Ranger District (Bitterroot NF) at Lost Trail Pass
USDA-Forest Service Humboldt National Forest Jarbidge Ranger District ATTN: John Caywood Buhl, ID 83316 208-543-4129	Air Resource Coordinator for the Jarbidge Wilderness
USDA-Forest Service Sawtooth National Forest ATTN: Rob Hendricks 2647 Kimberly Road East Twin Falls, ID 83301-7976 208-737-3200	Air Resource Coordinator Scott Phillips- Water sampling on the NRA
USDA-Foest Service ATTN: Bill Gabbert Ft. Collins, CO 80522 303-498-1273	Obtaining Ph.D. in Air Quality
Dr. Larry Munn Wyoming 307-766-2127	Professor in Botany
USDA-Forest Service Payette National Forest ATTN: Dave Kennell Box 1026 McCall, ID 83638 208-634-8151	Air Resource Coordinator

SCS- Montana Snow Survey ATTN: Phil Farnes and Richard Fike Fed. Bldg. 443 10 E. Babcock Bozeman, Mt. 59715 406-587-6844	Snow survey supervisor Hydrologist for snow survey
State of Utah Bureau of Air Quality ATTN: Carol Revelt Salt Lake City, UT 84401 801-538-6108	Coordinator for Acid Rain and compliance
Dr. Al Southard Soil and Metorlogy Utah State University UMC 48 Logan, UT 84322 801-750-2183	Professor of Soils, Soil Analysis Lab Supervisor - Karl Topper (801) 750-2217
Ray Dixon 1750 Foote Drive Idaho Falls, ID 83403 208-526-2329	Meteorlogical Service Branch of NOAA
EPA- Region 10 ATTN: John Schweiss ES-097 1200 6th Ave. Seattle, WA 98111 206-442-1690	Air monitoring & analysis section chief
University of California Davis Crocker Nuclear Lab. ATTN: Bob Eldred Pete Beveridge Davis, CA 916-752-1124	Particle Air Sampler Analysis Research Assoc. 916-752-4106
Jim Gelhaus P.O. Box 1175 Helena, Mt. 59624 406-458-5798	Air Quality Consultant
National Park Service Craters Of The Moon ATTEN: Neil King P.O. Box 29 Arco, Idaho 83213 208-527-3257	

Alchem Laboratory Atten: Dale Myers 104 W. 31 Street Boise, Idaho 83714 208-336-1172	Rainfall water chemistry
National Weather Service Metorlogist Pocatello, Idaho 208-236-6900	

APPENDIX

ESTABLISHMENT OF A LICHEN BIOMONITORING PROGRAM FOR THE SALMON NATIONAL FOREST

INTERIM REPORT

SUBMITTED TO:

GARY JACKSON
SALMON NATIONAL FOREST
SALMON, IDAHO

PREPARED BY:

LARRY L. ST. CLAIR
ASSOCIATE PROFESSOR OF BOTANY
DEPARTMENT OF BOTANY AND RANGE SCIENCE
BRIGAM YOUNG UNIVERSITY
PROVO, UTAH 84602

25 APRIL 1989

General Observations:

1. The lichen flora of the Salmon National Forest is diverse and well established at all study sites.
2. The Garden Creek site has the greatest species diversity and relative species abundance of the five sites evaluated thus far. In particular, the corticolous (bark) flora is very diverse, and includes a substantial number of foliose and fruticose species not found at the other sites. Increased species diversity and relative species abundance at this site may be related to the proximity of this site to the Salmon River, as well as the increased diversity of vascular plant substrates.
3. Copper, lead and sulfur values (see table 1) were consistently low for all test species at all study sites. Indeed, elemental analysis data from this study could very well be used as baseline clean air values for the same species throughout the Western United States.
4. Comparisons with similar studies in other wilderness areas, in the western United States, further substantiates the fact that the Salmon National Forest appears to be a relatively clean air area. For example, in the Jarbidge Wilderness Area, in northeastern Nevada, percent sulfur values for Letharia vulpina range from 0.102% to 0.226%, while in the Sawtooth National Recreation Area percent sulfur values for the same species ranges between 0.118% and 0.179%. Generally, thallus sulfur values above the 0.20% level, in corticolous species, are considered to be potentially hazardous.

TABLE 1 ELEMENTAL ANALYSIS DATA FOR SELECTED LICHEN SPECIES FROM SELECTED SITES IN THE SALMON NATIONAL FOREST.

STUDY SITE SPECIES/SUBSTRATE	Cu (ppm)	Pb (ppm)	S (%)
GARDEN CREEK			
Letharia vulpina (bark)	4.90	7.60	0.025
Umbilicaria vellea (rock)	11.10	11.90	0.157
GOLDEN TROUT LAKE			
Letharia vulpina (bark)	7.80	7.10	0.11
Letharia columbiana (bark)	9.30	9.10	0.056
Umbilicaria vellea (rock)	8.50	15.50	0.112
HARBOR LAKE			
Letharia vulpina (bark)	5.10	10.50	0.093
Letharia columbiana (bark)	5.70	9.60	0.135
CRAGS HIGH POINT			
Letharia columbiana (bark)	5.88	3.88	0.102
HAT CREEKS			
Letharia vulpina (bark)	3.0	9.40	0.056
Letharia columbiana (bark)	3.90	12.70	0.066
Umbilicaria vellea (rock)	5.70	11.90	0.07

Methods for determining lead, sulfur and copper values in lichen tissues:

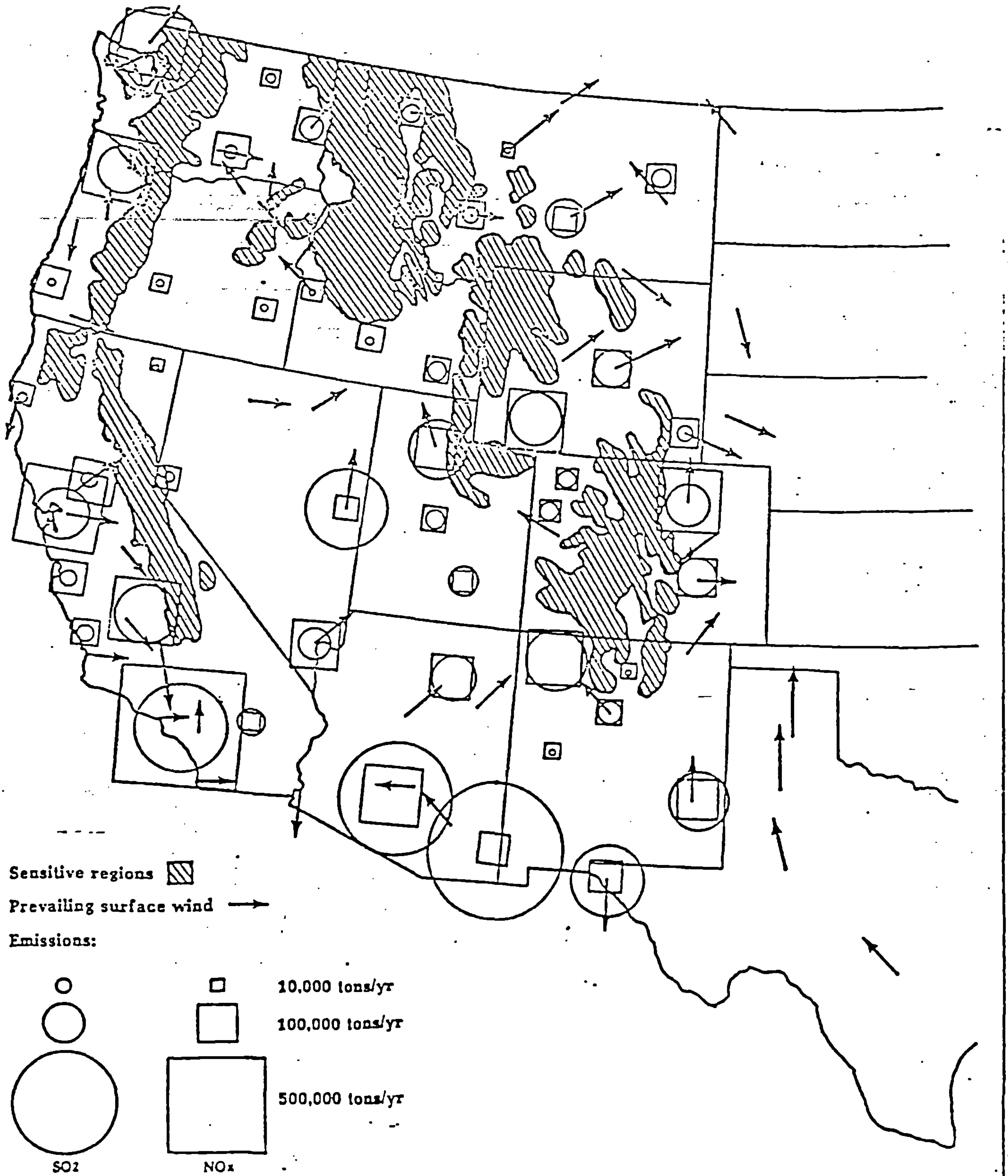
Upon returning to the laboratory all samples were thoroughly washed with distilled water to remove surface debris and dust. Samples were then allowed to air dry. Subsequently, ten 500 mg samples for each species from each study site were weighed out and oven dried. Afterwards, all samples were ground to powder and wet ashed using perchloric acid. Lead and copper content were determined by atomic absorption, and total sulfur was assessed turbidimetrically using barium chloride.

Information which will be included in the lichen species checklist for the Salmon National Forest:

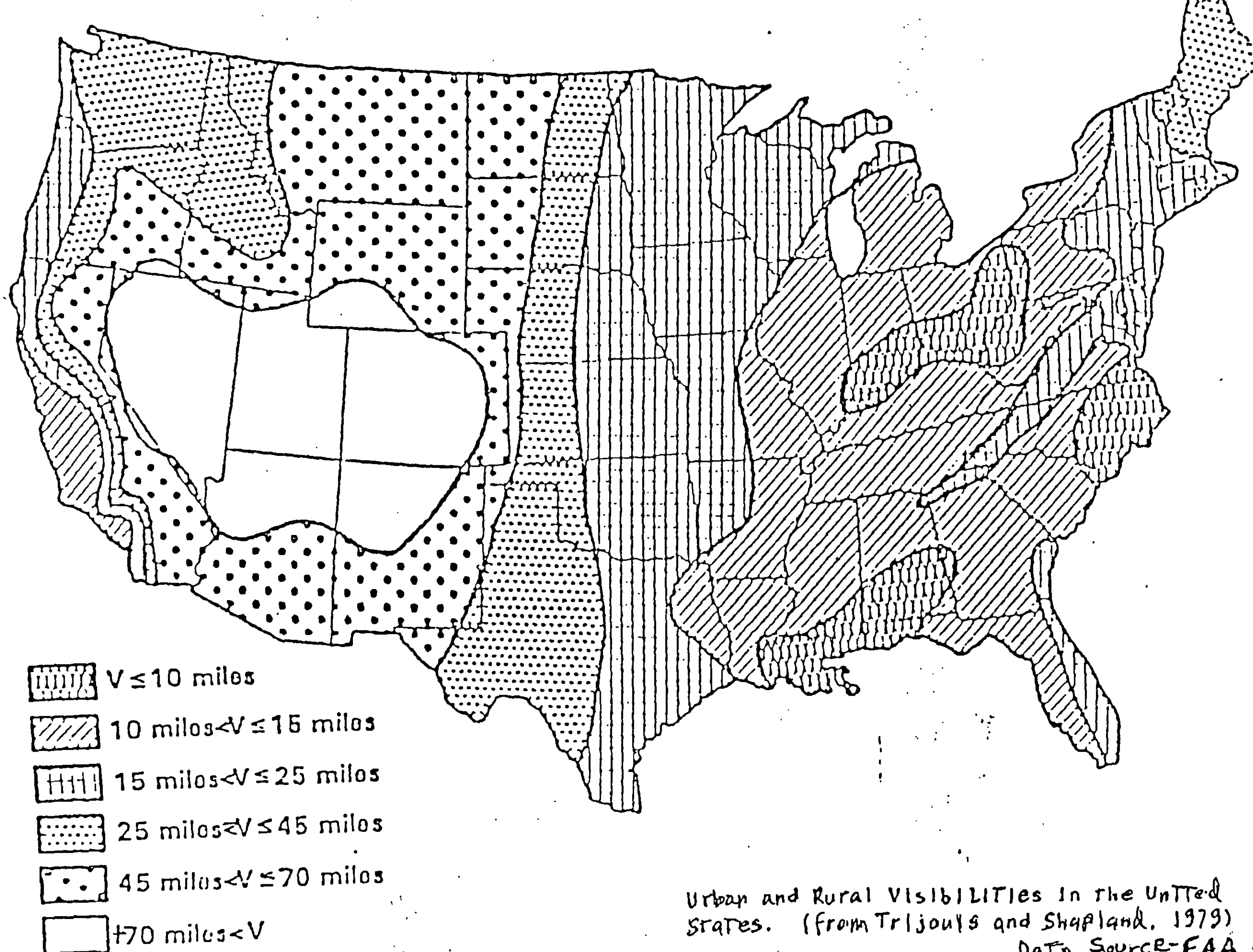
The list of lichen species for the Salmon National Forest will include the following information:

1. an alphabetical listing of the lichen by genus and by species.
2. distribution information for each species at each study site.
3. substrate information for each species.
4. an indication of the relative abundance of each species following the pattern listed below:
   a. abundant
   b. common
   c. rare

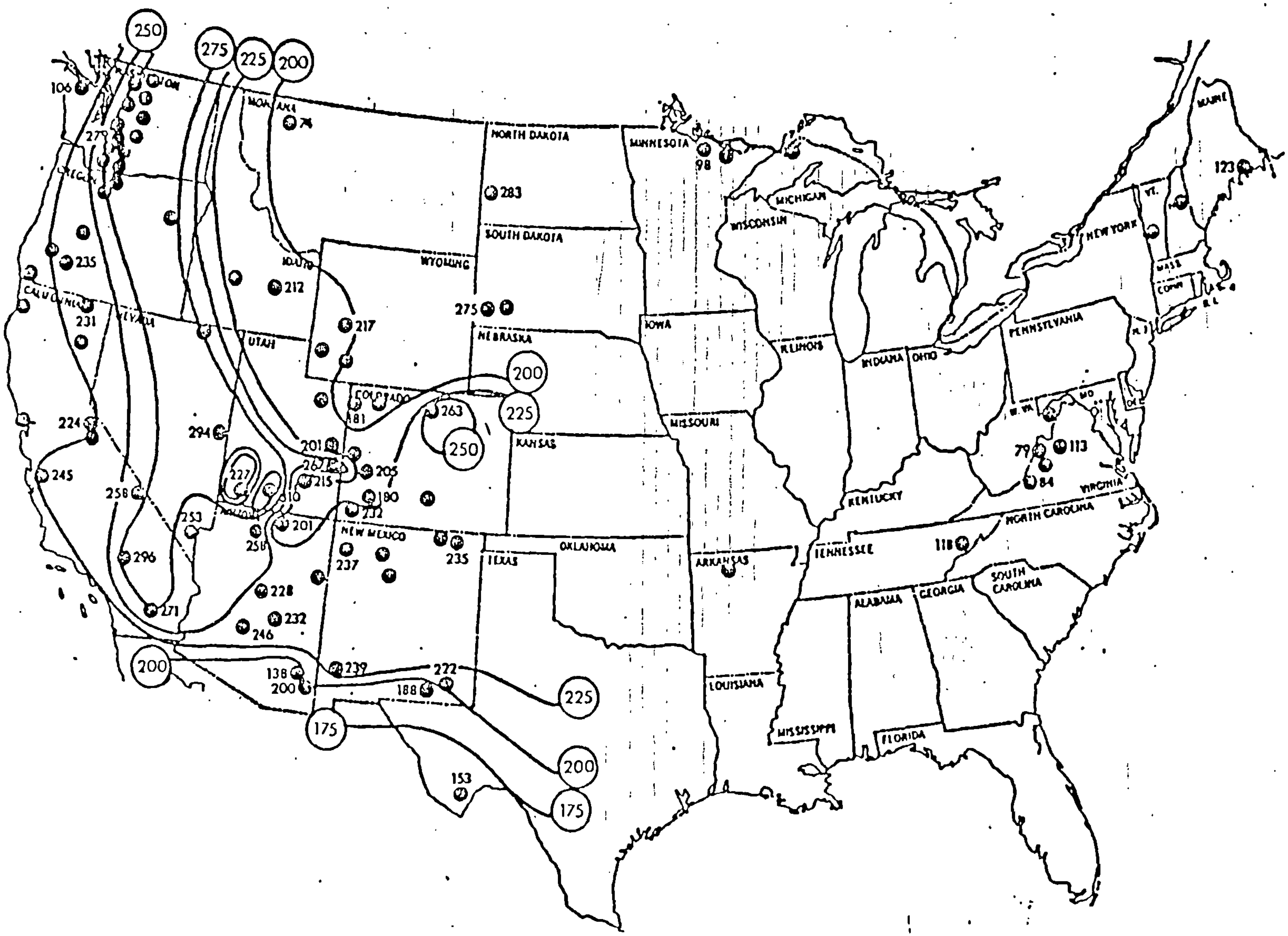
Emission Sources and Prevailing Winds in Relation to Sensitive Regions in the West



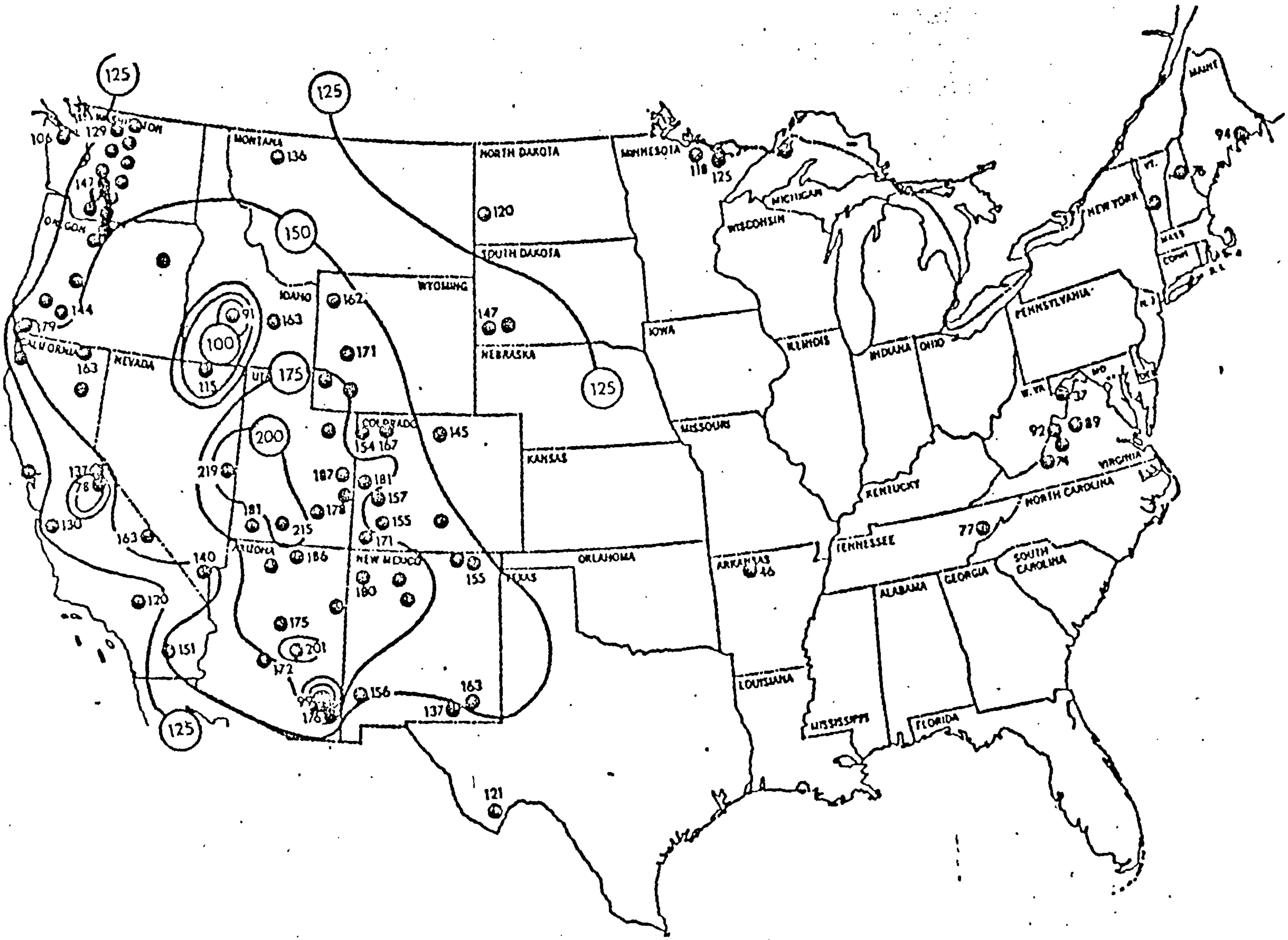
Sources: Sensitive regions — chapter 3 (EPA)
Emissions — chapter 4 (EPA-NEDS)
Prevailing winds — Climatic Atlas of the United States



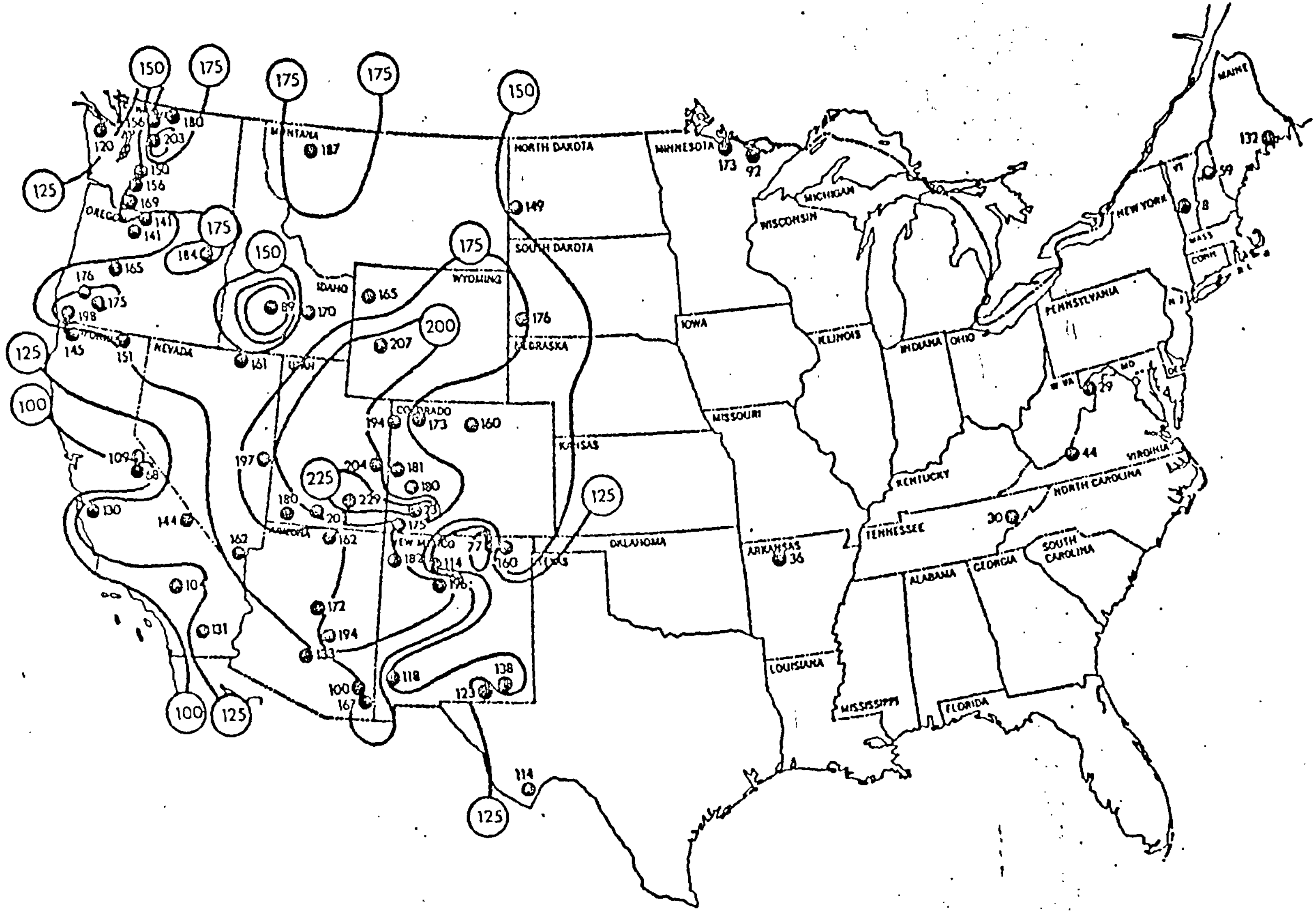
Urban and Rural Visibilities in the United States. (from Trijonis and Shapland, 1979)
Data Source-FAA Airport



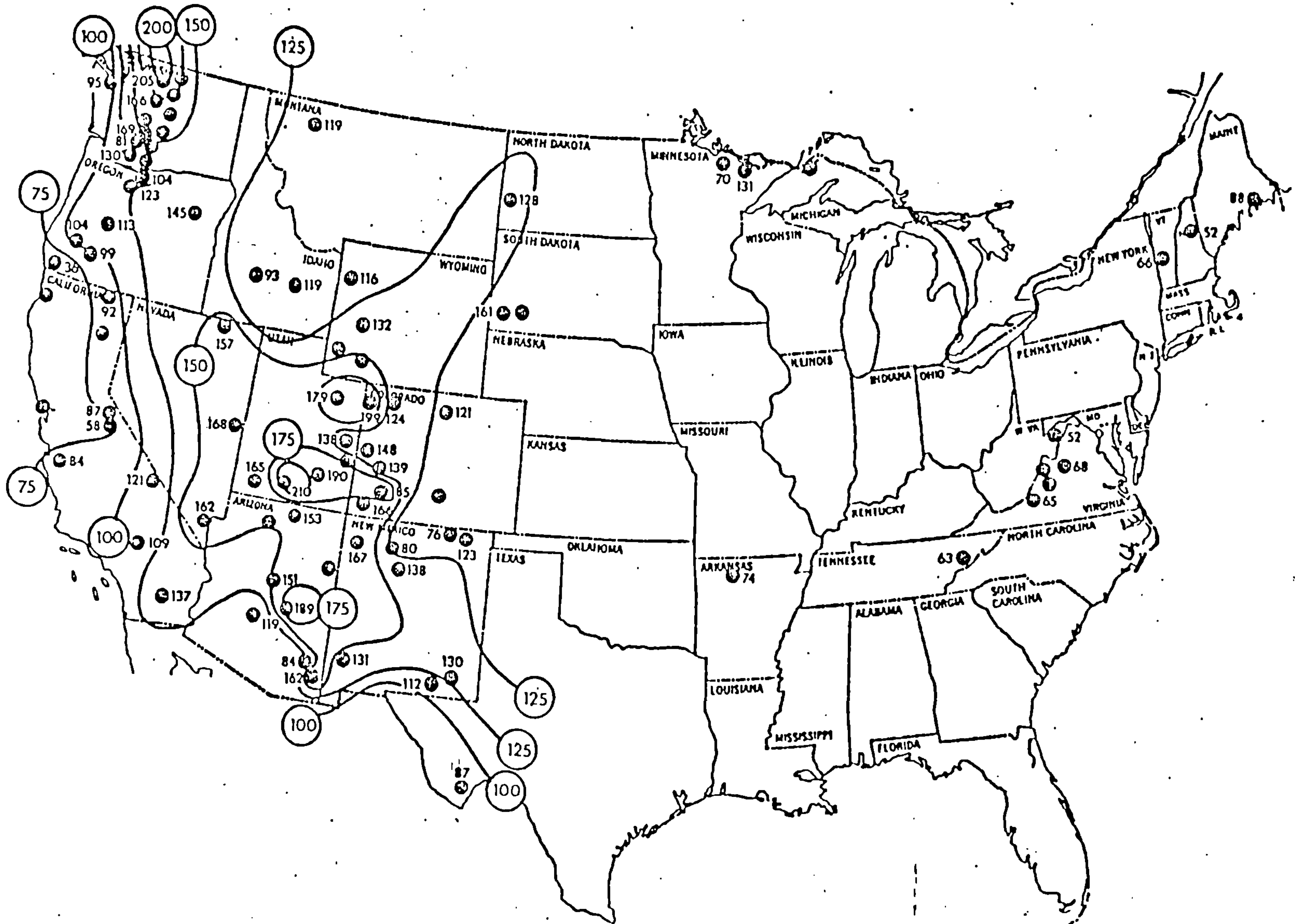
Winter 1987 Contour Plot of Seasonal Mean Standard Visual Ranges (50% SVR Value).



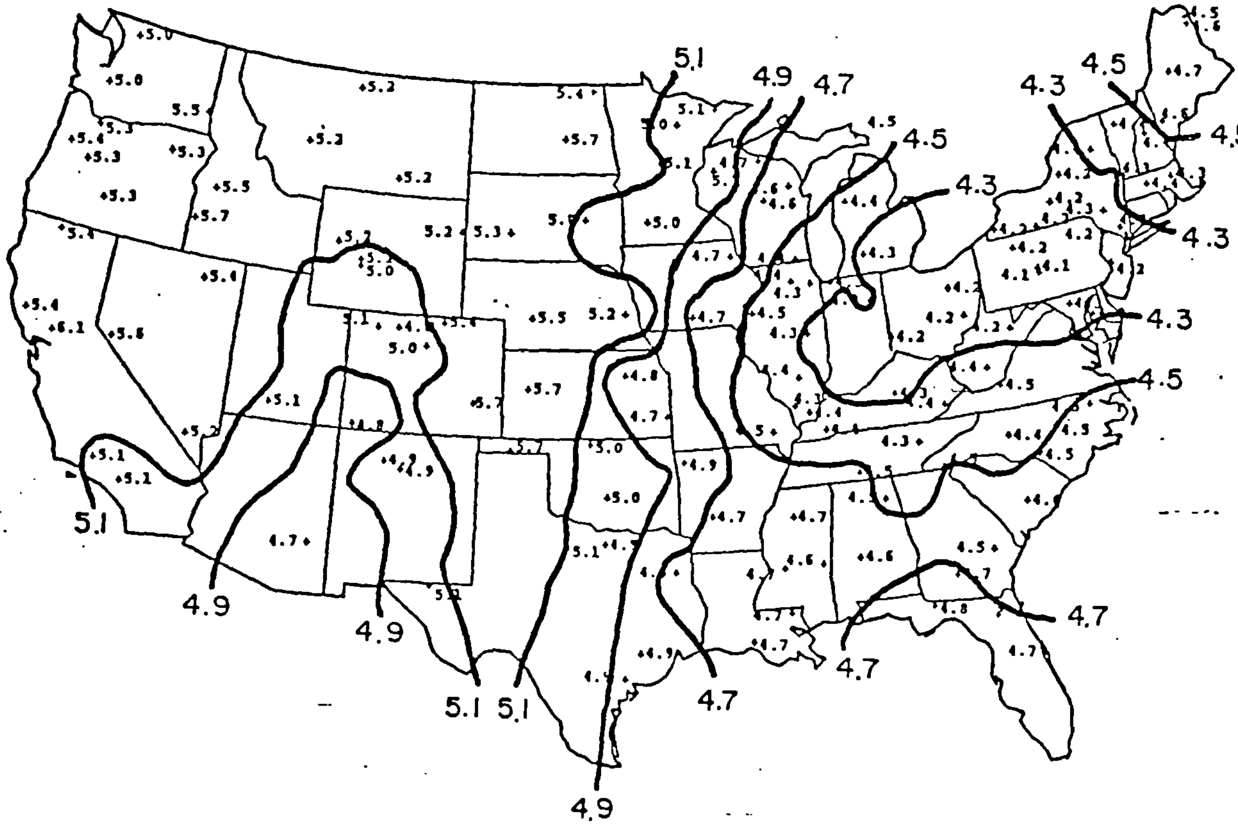
Spring 1987 Contour Plot of Seasonal Mean Standard Visual Ranges (50% SVR Value).



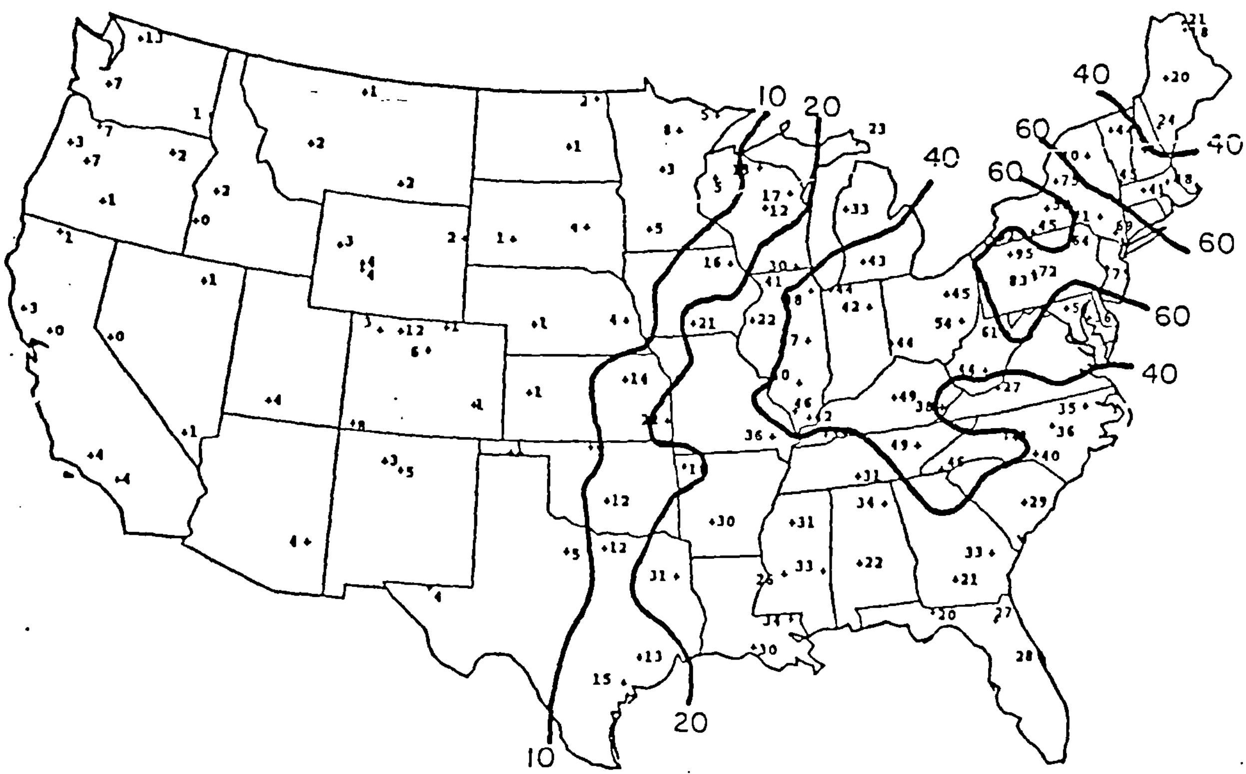
Summer 1987 Contour Plot of Seasonal Mean Standard Visual Ranges (50% SVR Value).



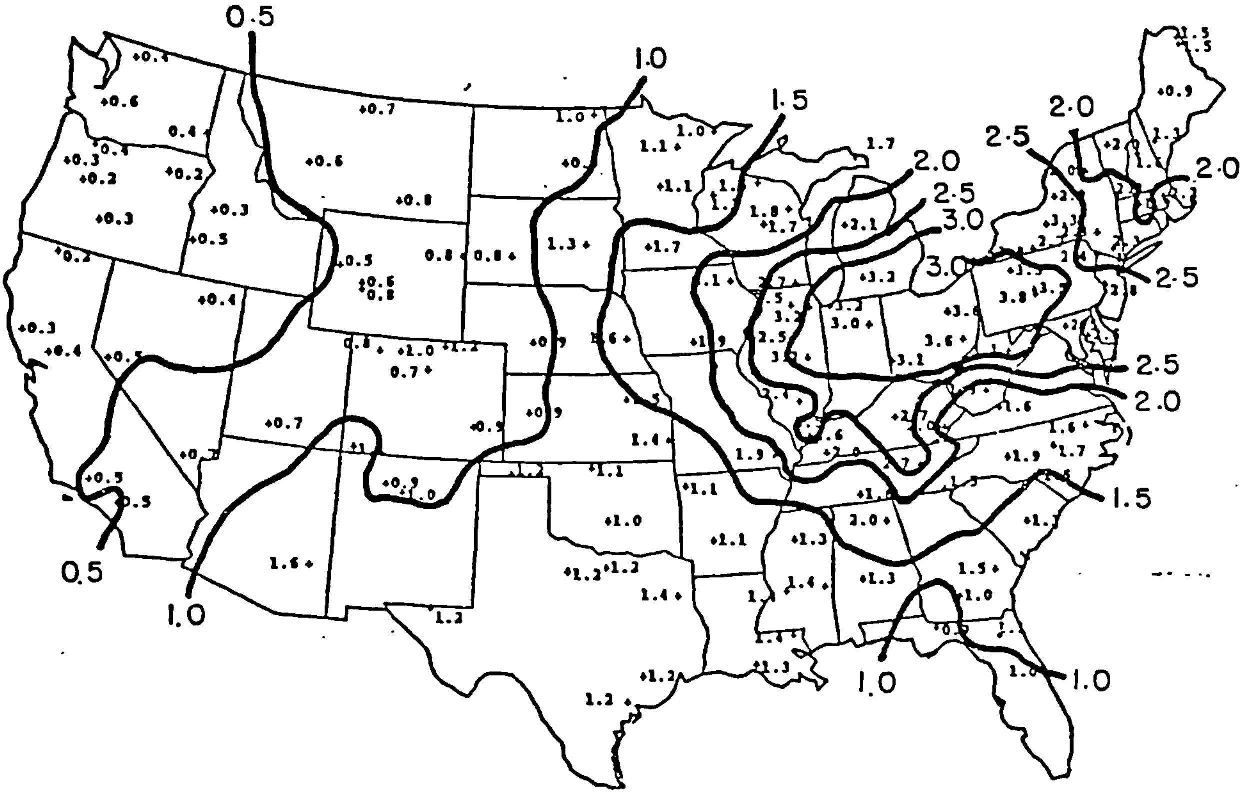
Fall 1987 Contour Plot of Seasonal Mean Standard Visual Ranges (50% SVR Value).



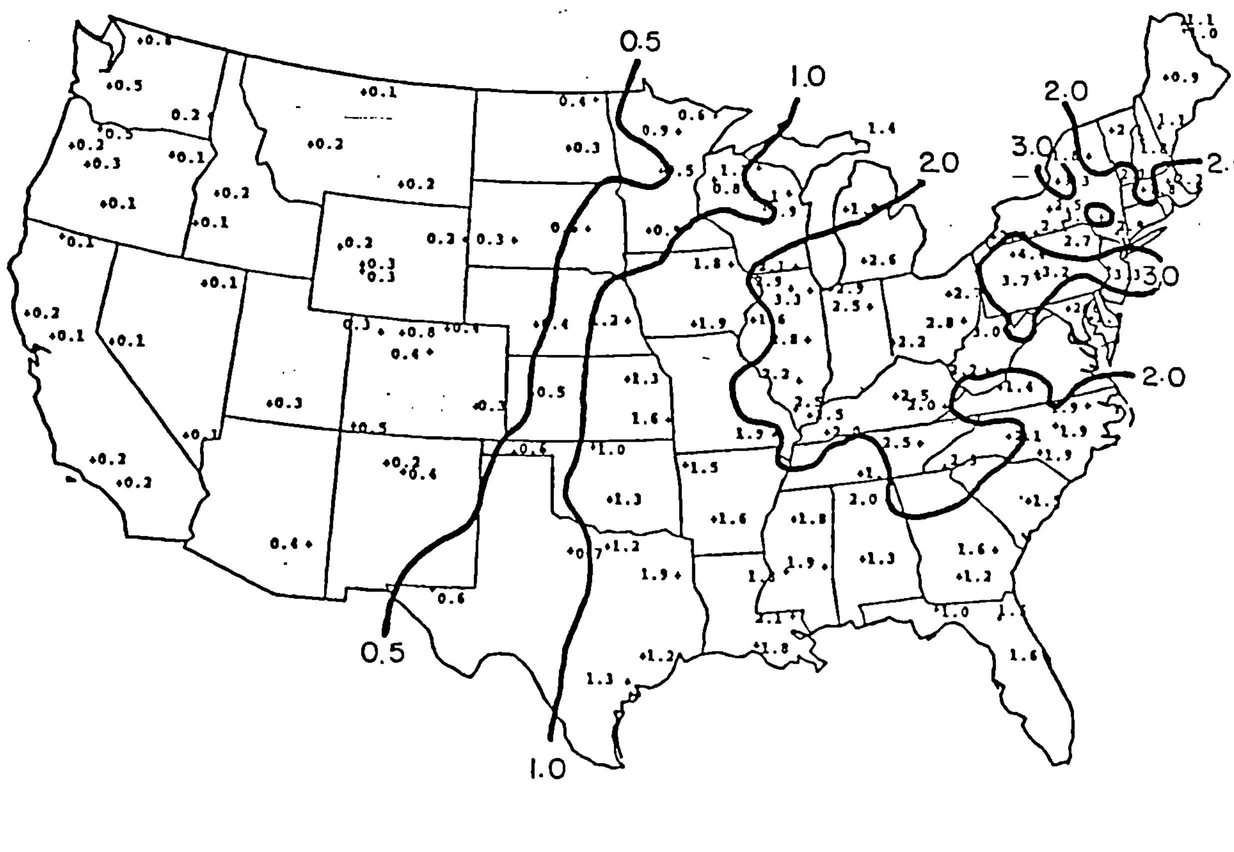
1987 annual precipitation-weighted mean hydrogen ion concentrations as pH.



Measured hydrogen ion deposition (mg/m^2) for 1987.

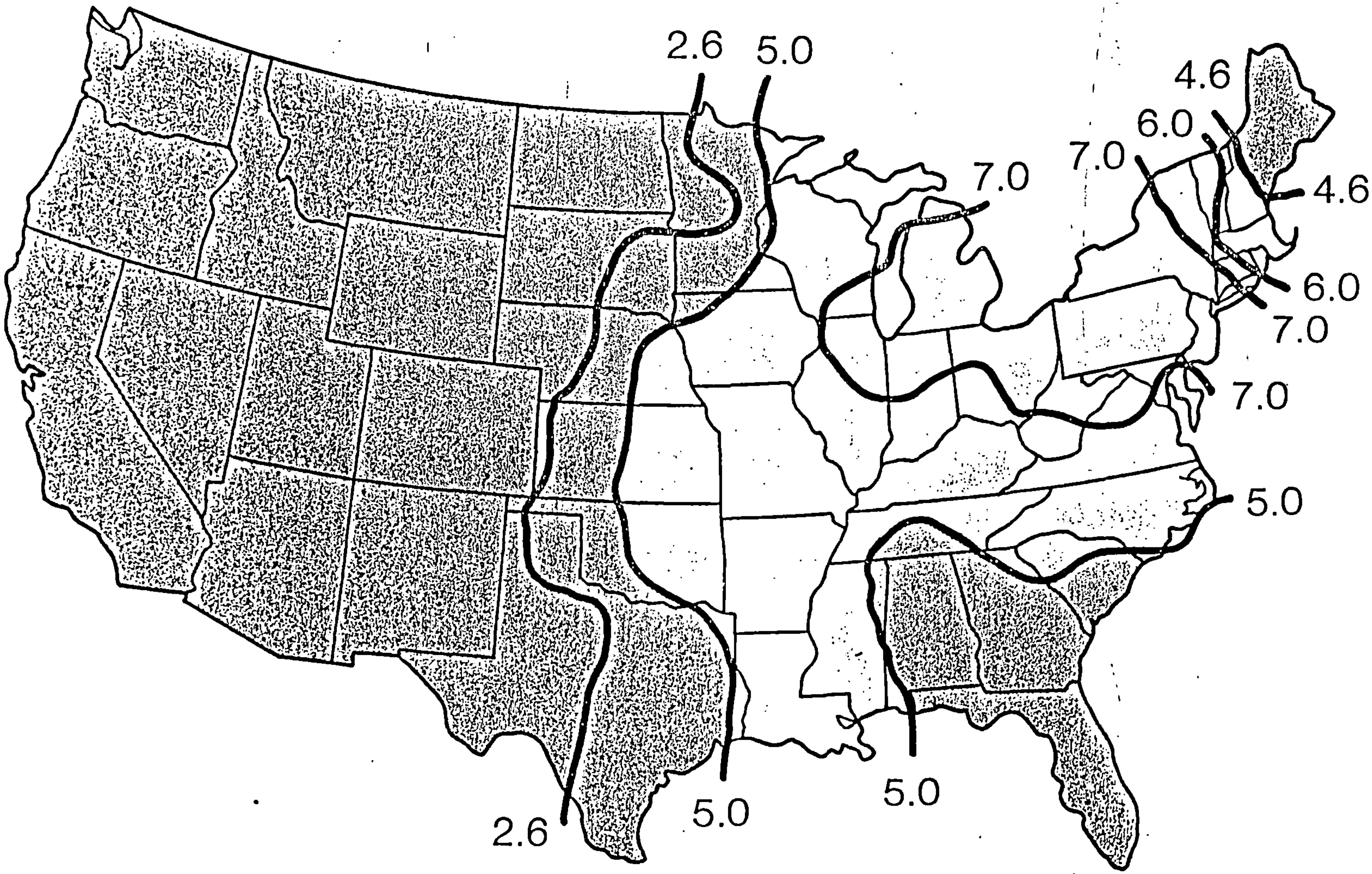


1987 annual precipitation-weighted mean sulfate ion concentrations (mg/L).



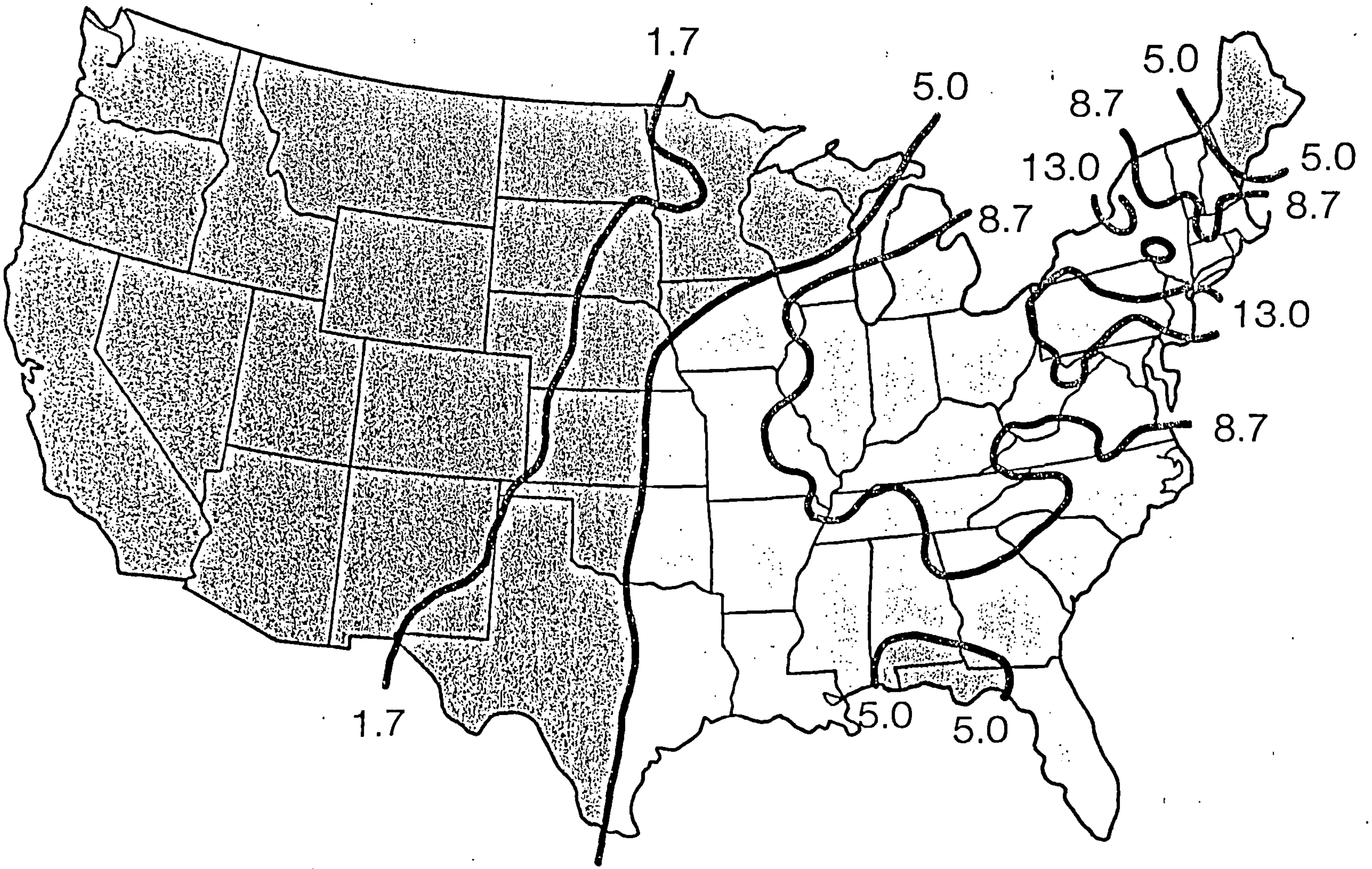
Measured sulfate ion deposition (g/m^2) for 1987.

ESTIMATED TOTAL NITROGEN DEPOSITION*(Kg/HA) FOR 1987



* includes wet N, NH^4 and added 30% for dry deposition

ESTIMATED TOTAL SULFUR DEPOSITION (Kg/HA) FOR 1987



NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

REYNOLDS CREEK Station Number: 131180 CAL Code: ID11
Owyhee County, ID Elevation: 1198 meters Latitude: 43 12 19 Longitude: 116 44 57
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1983	6.0	11.8	33.2	52.9	0.05	0.016	0.024	0.036	0.07	0.33	0.09	0.27	5.51	3.7	1175.7	9.85	43	6	831122 840104
1984	86.6	99.7	95.1	78.4	0.20	0.047	0.040	0.221	0.14	0.56	0.18	0.65	5.64	5.5	15477.4	31.17	364	52	840104 850102
1985	90.4	99.7	95.7	80.4	0.17	0.035	0.050	0.134	0.16	0.50	0.12	0.40	5.56	5.2	13274.5	25.45	363	52	850102 851231
1986	87.9	100.0	93.5	86.9	0.13	0.020	0.020	0.101	0.06	0.30	0.07	0.28	5.49	4.0	15844.5	28.78	364	52	851231 861230
1987	92.3	100.0	91.0	90.1	0.22	0.027	0.030	0.179	0.25	0.69	0.17	0.51	5.66	6.1	12423.7	22.45	364	52	861230 871229
FALL																			
1984	76.9	100.0	86.3	78.5	0.24	0.049	0.042	0.499	0.08	0.33	0.30	0.87	5.68	6.1	4007.5	8.71	91	13	840904 841204
1985	84.6	100.0	92.8	77.4	0.06	0.016	0.021	0.174	0.01	0.25	0.08	0.20	5.45	3.7	5484.4	11.25	91	13	850903 851203
1986	90.1	100.0	87.6	95.5	0.19	0.022	0.045	0.245	0.10	0.65	0.13	0.49	5.46	6.1	3259.6	5.74	91	13	860902 861202
1987	100.0	100.0	100.0	77.6	0.08	0.016	0.019	0.110	0.15	0.68	0.11	0.34	5.67	4.6	709.3	1.37	91	13	870901 871201
WINTER																			
1984	70.3	100.0	50.7	47.6	0.13	0.040	0.047	0.108	0.10	0.48	0.15	0.35	5.70	4.6	2207.1	13.49	91	13	831129 840228
1985	78.0	100.0	95.9	56.6	0.19	0.081	0.034	0.191	0.05	0.40	0.16	0.43	5.67	4.8	1601.6	4.36	91	13	841204 850305
1986	100.0	100.0	100.0	78.4	0.04	0.007	0.010	0.042	0.02	0.08	0.03	0.10	5.47	2.3	6623.2	12.47	91	13	851203 860304
1987	61.5	100.0	58.7	80.6	0.09	0.019	0.013	0.141	0.14	0.72	0.09	0.42	5.34	5.3	1555.3	4.86	91	13	861202 870303
1988	92.3	100.0	99.6	79.6	0.31	0.023	0.027	0.316	0.10	0.38	0.27	0.37	5.73	6.0	3020.3	5.63	91	13	871201 880301
SPRING																			
1984	100.0	100.0	100.0	80.7	0.18	0.034	0.017	0.145	0.09	0.34	0.13	0.56	5.80	4.1	4119.5	7.53	91	13	840228 840529
1985	92.3	100.0	98.3	85.4	0.19	0.030	0.043	0.081	0.30	0.67	0.12	0.51	5.67	5.6	4977.0	8.74	91	13	850305 850604
1986	92.3	100.0	94.2	91.1	0.24	0.036	0.017	0.091	0.05	0.28	0.10	0.39	5.52	4.7	4836.2	8.32	91	13	860304 860603
1987	100.0	100.0	100.0	92.5	0.16	0.025	0.022	0.078	0.30	0.63	0.06	0.44	5.92	5.2	5984.0	9.54	91	13	870303 870602
1988	92.3	100.0	98.4	89.0	0.22	0.026	0.022	0.179	0.16	0.59	0.14	0.55	5.82	5.5	3899.1	6.57	91	13	880301 880531
SUMMER																			
1984	85.7	100.0	97.8	95.0	0.17	0.043	0.045	0.080	0.25	0.98	0.13	0.65	5.44	6.2	5474.2	9.22	98	14	840529 840904
1985	100.0	100.0	100.0	107.0	1.04	0.152	0.346	0.181	0.55	1.59	0.38	1.38	6.06	16.3	1126.3	1.56	91	13	850604 850903
1986	84.6	100.0	75.0	102.0	0.14	0.029	0.032	0.056	0.16	0.67	0.05	0.36	5.75	5.0	1301.5	2.54	91	13	860603 860902
1987	92.3	100.0	98.5	95.4	0.25	0.033	0.051	0.233	0.33	1.08	0.29	0.76	5.48	8.0	3126.8	4.95	91	13	870602 870901
1988	84.6	100.0	97.1	96.6	0.15	0.022	0.018	0.121	0.01	0.41	0.14	0.46	5.30	6.4	816.3	1.32	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

REYNOLDS CREEK Station Number: 131180 CAL Code: ID11
Owyhee County, ID Elevation: 1198 meters Latitude: 43 12 19 Longitude: 116 44 57

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1983	6.0	11.8	33.2	52.9	2.30	1.32	0.61	1.57	3.83	5.34	2.60	5.64	3.1261	3.7	1175.7	9.85	43	6	831122 840104
1984	86.6	99.7	95.1	78.4	9.93	3.87	1.02	9.61	7.76	9.11	5.13	13.54	2.2646	5.5	15477.4	31.17	364	52	840104 850102
1985	90.4	99.7	95.7	80.4	8.73	2.88	1.28	5.83	8.65	8.00	3.27	8.39	2.7416	5.2	13274.5	25.45	363	52	850102 851231
1986	87.9	100.0	93.5	86.9	6.59	1.65	0.51	4.39	3.10	4.84	2.06	5.83	3.1989	4.0	15844.5	28.78	364	52	851231 861230
1987	92.3	100.0	91.0	90.1	10.93	2.22	0.77	7.79	13.69	11.11	4.82	10.54	2.1627	6.1	12423.7	22.45	364	52	861230 871229
FALL																			
1984	76.9	100.0	86.3	78.5	11.93	4.03	1.07	21.71	4.44	5.31	8.43	18.10	2.0654	6.1	4007.5	8.71	91	13	840904 841204
1985	84.6	100.0	92.8	77.4	3.14	1.32	0.54	7.57	0.72	4.11	2.12	4.08	3.5810	3.7	5484.4	11.25	91	13	850903 851203
1986	90.1	100.0	87.6	95.5	9.28	1.81	1.15	10.66	5.60	10.52	3.55	10.19	3.4834	6.1	3259.6	5.74	91	13	860902 861202
1987	100.0	100.0	100.0	77.6	3.79	1.32	0.49	4.78	8.43	10.92	3.16	7.04	2.1232	4.6	709.3	1.37	91	13	870901 871201
WINTER																			
1984	70.3	100.0	50.7	47.6	6.49	3.29	1.20	4.70	5.65	7.74	4.18	7.21	2.0184	4.6	2207.1	13.49	91	13	831129 840228
1985	78.0	100.0	95.9	56.6	9.58	6.66	0.87	8.31	2.88	6.48	4.49	9.02	2.1281	4.8	1601.6	4.36	91	13	841204 850305
1986	100.0	100.0	100.0	78.4	1.80	0.58	0.26	1.83	1.22	1.29	0.85	2.08	3.4277	2.3	6623.2	12.47	91	13	851203 860304
1987	61.5	100.0	58.7	80.6	4.74	1.56	0.33	6.13	7.60	11.61	2.60	8.81	4.5920	5.3	1555.3	4.86	91	13	861202 870303
1988	92.3	100.0	99.6	79.6	15.47	1.89	0.69	13.75	5.60	6.10	7.53	7.60	1.8793	6.0	3020.3	5.63	91	13	871201 880301
SPRING																			
1984	100.0	100.0	100.0	80.7	9.03	2.80	0.43	6.31	5.05	5.48	3.67	11.64	1.6032	4.1	4119.5	7.53	91	13	840228 840529
1985	92.3	100.0	98.3	85.4	9.23	2.47	1.10	3.52	16.69	10.82	3.39	10.66	2.1281	5.6	4977.0	8.74	91	13	850305 850604
1986	92.3	100.0	94.2	91.1	12.03	2.96	0.43	3.96	2.72	4.47	2.93	8.12	2.9923	4.7	4836.2	8.32	91	13	860304 860603
1987	100.0	100.0	100.0	92.5	8.18	2.06	0.56	3.39	16.63	10.13	1.78	9.21	1.2023	5.2	5984.0	9.54	91	13	870303 870602
1988	92.3	100.0	98.4	89.0	11.08	2.14	0.56	7.79	8.93	9.58	3.86	11.48	1.4997	5.5	3899.1	6.57	91	13	880301 880531
SUMMER																			
1984	85.7	100.0	97.8	95.0	8.58	3.54	1.15	3.48	14.08	15.87	3.53	13.64	3.6308	6.2	5474.2	9.22	98	14	840529 840904
1985	100.0	100.0	100.0	107.0	52.00	12.50	8.85	7.87	30.44	25.66	10.80	28.85	0.8670	16.3	1126.3	1.56	91	13	850604 850903
1986	84.6	100.0	75.0	102.0	7.19	2.39	0.82	2.44	9.04	10.76	1.38	7.52	1.7947	5.0	1301.5	2.54	91	13	860603 860902
1987	92.3	100.0	98.5	95.4	12.23	2.71	1.30	10.14	18.13	17.45	8.07	15.89	3.3189	8.0	3126.8	4.95	91	13	870602 870901
1988	84.6	100.0	97.1	96.6	7.29	1.81	0.46	5.26	0.61	6.61	3.98	9.54	5.0350	6.4	816.3	1.32	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

CRATERS OF THE MOON NAT'L MON. Station Number: 130340 CAL Code: ID03
Butte County, ID Elevation: 1807 meters Latitude: 43 27 41 Longitude: 113 33 17
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1980	26.6	31.9	90.2	107.4	0.48	0.054	0.135	0.376	0.12	0.68	0.47	0.92	5.72	8.3	7753.2	12.02	130	18	800822 801230
1981	87.1	98.1	72.3	86.2	0.28	0.065	0.048	0.149	0.14	0.53	0.21	0.97	5.07	10.6	20619.9	48.48	364	52	801230 811229
1982	75.5	100.0	63.9	85.4	0.18	0.033	0.058	0.073	0.19	0.65	0.17	0.68	5.30	7.2	21578.1	57.51	371	53	811229 830104
1983	73.1	100.0	74.7	90.7	0.20	0.031	0.029	0.089	0.19	0.57	0.17	0.65	5.39	6.1	23103.9	49.20	364	52	830104 840103
1984	72.9	100.0	89.1	95.9	0.18	0.040	0.025	0.095	0.19	0.67	0.17	0.62	5.38	6.3	21289.0	36.52	365	52	840103 850102
1985	63.2	99.7	65.3	78.3	0.25	0.040	0.029	0.090	0.18	0.64	0.15	0.58	5.56	5.9	10480.8	29.73	363	52	850102 851231
1986	57.7	100.0	27.3	85.6	0.49	0.060	0.076	0.197	0.16	1.08	0.30	0.83	5.54	9.7	4841.4	30.76	364	52	851231 861230
1987	67.3	100.0	50.1	86.8	0.21	0.026	0.033	0.158	0.18	0.77	0.17	0.62	5.26	7.1	9190.3	31.08	364	52	861230 871229
FALL																			
1980	73.7	84.2	85.6	146.4	0.37	0.048	0.199	0.207	0.18	0.92	0.43	0.77	5.44	8.1	4088.0	5.87	94	13	800829 801201
1981	76.9	100.0	35.6	81.4	0.49	0.172	0.063	0.204	0.11	0.93	0.30	1.19	5.53	8.7	2596.8	13.26	91	13	810901 811201
1982	76.9	100.0	92.1	91.2	0.10	0.019	0.020	0.052	0.13	0.41	0.14	0.55	5.29	5.8	5040.0	8.82	91	13	820831 821130
1983	100.0	100.0	100.0	95.0	0.23	0.036	0.030	0.106	0.13	0.46	0.18	0.59	5.47	5.2	8701.3	13.36	91	13	830830 831129
1984	84.6	100.0	92.6	93.0	0.16	0.043	0.021	0.090	0.07	0.45	0.15	0.50	5.35	4.8	5926.1	9.98	91	13	840904 841204
1985	76.9	100.0	74.8	67.2	0.41	0.052	0.049	0.104	0.04	0.52	0.19	0.58	5.44	7.2	3027.0	8.09	91	13	850903 851203
1986	84.6	100.0	54.5	92.1	0.21	0.026	0.080	0.221	0.09	0.70	0.16	0.62	5.34	8.1	1842.0	5.47	91	13	860902 861202
1987	100.0	100.0	100.0	78.6	0.05	0.011	0.014	0.071	0.05	0.67	0.14	0.58	4.97	7.8	1315.6	2.48	91	13	870901 871201
WINTER																			
1981	84.8	100.0	87.7	76.0	0.41	0.041	0.069	0.303	0.11	0.64	0.39	1.32	4.79	14.5	7027.4	15.53	92	13	801201 810303
1982	92.3	100.0	98.4	78.1	0.09	0.028	0.077	0.108	0.05	0.19	0.14	0.43	5.56	4.0	9160.5	17.55	91	13	811201 820302
1983	7.7	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	18.24	91	13	821130 830301
1984	61.5	100.0	81.7	79.8	0.09	0.031	0.016	0.097	0.04	0.38	0.13	0.50	5.51	4.1	5030.0	9.78	91	13	831129 840228
1985	75.8	100.0	99.3	76.2	0.11	0.030	0.013	0.084	0.07	0.41	0.12	0.32	5.49	3.7	4351.6	8.47	91	13	841204 850305
1986	38.5	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	13.06	91	13	851203 860304
1987	38.5	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	5.55	91	13	861202 870303
1988	92.3	100.0	95.4	52.5	0.12	0.015	0.037	0.123	0.08	0.38	0.17	0.29	5.59	4.8	2002.7	5.55	91	13	871201 880301
SPRING																			
1981	76.9	92.3	78.6	103.0	0.12	0.030	0.016	0.050	0.19	0.36	0.08	0.60	5.44	8.8	8496.7	15.53	91	13	810303 810602
1982	76.9	100.0	49.1	81.9	0.17	0.034	0.013	0.054	0.24	0.65	0.14	0.80	5.30	7.2	5845.9	21.41	91	13	820302 820601
1983	84.6	92.3	91.8	85.8	0.14	0.023	0.015	0.074	0.28	0.43	0.13	0.61	5.81	5.1	5658.8	10.57	91	13	830301 830531
1984	53.8	100.0	70.2	78.4	0.42	0.059	0.028	0.210	0.39	0.78	0.20	0.86	6.27	8.7	2153.8	5.09	91	13	840228 840529
1985	61.5	100.0	92.4	98.4	0.29	0.043	0.030	0.092	0.44	1.10	0.15	0.93	5.84	7.5	3935.6	6.38	91	13	850305 850604
1986	30.8	100.0	12.2	53.2	0.87	0.094	0.073	0.419	0.44	1.79	0.38	1.50	6.32	13.6	440.4	10.11	91	13	860304 860603
1987	53.8	100.0	61.4	88.8	0.31	0.036	0.030	0.278	0.18	0.61	0.16	0.74	5.55	6.8	3186.2	8.62	91	13	870303 870602
1988	69.2	100.0	100.0	44.8	0.53	0.056	0.049	0.277	0.21	0.69	0.24	0.95	6.03	8.8	1513.6	3.17	91	13	880301 880531

SUMMER

1981	100.0	100.0	100.0	102.8	0.95	0.203	0.219	0.488	0.11	0.87	0.63	1.80	5.80	14.8	1702.0	2.45	91	13	810602	810901
1982	92.3	100.0	99.9	102.0	0.39	0.063	0.076	0.123	0.35	1.31	0.25	1.00	5.16	12.3	5885.2	8.56	91	13	820601	820831
1983	84.6	100.0	86.2	90.6	0.32	0.045	0.057	0.116	0.29	1.01	0.22	0.90	5.09	10.1	5269.3	9.91	91	13	830531	830830
1984	78.6	100.0	95.6	100.2	0.14	0.027	0.026	0.047	0.26	0.83	0.18	0.65	5.27	7.0	10820.2	16.64	98	14	840529	840904
1985	38.5	100.0	1.0	--	--	--	--	--	--	--	--	--	--	--	--	3.87	91	13	850604	850903
1986	76.9	100.0	71.4	90.5	0.57	0.074	0.074	0.114	0.13	1.14	0.37	0.78	5.62	9.7	2559.0	5.85	91	13	860603	860902
1987	69.2	100.0	43.6	92.9	0.22	0.029	0.040	0.092	0.28	1.14	0.19	0.69	5.17	8.3	3330.8	12.13	91	13	870602	870901
1988	100.0	100.0	100.0	79.1	0.44	0.051	0.042	0.146	0.21	1.04	0.40	0.90	5.84	10.3	1460.3	2.72	91	13	880531	880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

CRATERS OF THE MOON NAT'L MON. Station Number: 130340 CAL Code: ID03
Butte County, ID Elevation: 1807 meters Latitude: 43 27 41 Longitude: 113 33 17

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1980	26.6	31.9	90.2	107.4	24.00	4.44	3.45	16.36	6.60	10.92	13.17	19.18	1.9099	8.3	7753.2	12.02	130	18	800822 801230
1981	87.1	98.1	72.3	86.2	13.72	5.35	1.23	6.48	7.82	8.58	6.01	20.25	8.5507	10.6	20619.9	48.48	364	52	801230 811229
1982	75.5	100.0	63.9	85.4	8.83	2.71	1.48	3.18	10.42	10.52	4.88	14.06	5.0003	7.2	21578.1	57.51	371	53	811229 830104
1983	73.1	100.0	74.7	90.7	9.98	2.55	0.74	3.87	10.81	9.16	4.71	13.52	4.0926	6.1	23103.9	49.20	364	52	830104 840103
1984	72.9	100.0	89.1	95.9	9.08	3.29	0.64	4.13	10.81	10.82	4.80	12.96	4.1783	6.3	21289.0	36.52	365	52	840103 850102
1985	63.2	99.7	65.3	78.3	12.72	3.29	0.74	3.92	9.92	10.39	4.29	12.19	2.7797	5.9	10480.8	29.73	363	52	850102 851231
1986	57.7	100.0	27.3	85.6	24.20	4.94	1.94	8.57	8.93	17.40	8.35	17.27	2.8774	9.7	4841.4	30.76	364	52	851231 861230
1987	67.3	100.0	50.1	86.8	10.58	2.14	0.84	6.87	9.76	12.48	4.82	12.94	5.4828	7.1	9190.3	31.08	364	52	861230 871229
FALL																			
1980	73.7	84.2	85.6	146.4	18.26	3.95	5.09	9.00	9.81	14.79	12.19	15.96	3.6058	8.1	4088.0	5.87	94	13	800829 801201
1981	76.9	100.0	35.6	81.4	24.45	14.15	1.61	8.87	6.15	15.03	8.35	24.83	2.9580	8.7	2596.8	13.26	91	13	810901 811201
1982	76.9	100.0	92.1	91.2	4.94	1.56	0.51	2.26	7.26	6.60	3.98	11.44	5.1761	5.8	5040.0	8.82	91	13	820831 821130
1983	100.0	100.0	100.0	95.0	11.48	2.96	0.77	4.61	7.37	7.48	5.02	12.35	3.4041	5.2	8701.3	13.36	91	13	830830 831129
1984	84.6	100.0	92.6	93.0	7.88	3.54	0.54	3.92	3.99	7.26	4.32	10.48	4.4668	4.8	5926.1	9.98	91	13	840904 841204
1985	76.9	100.0	74.8	67.2	20.21	4.28	1.25	4.52	2.44	8.34	5.36	12.16	3.6475	7.2	3027.0	8.09	91	13	850903 851203
1986	84.6	100.0	54.5	92.1	10.58	2.14	2.05	9.61	5.16	11.31	4.49	12.89	4.5709	8.1	1842.0	5.47	91	13	860902 861202
1987	100.0	100.0	100.0	78.6	2.69	0.90	0.36	3.09	2.83	10.79	4.01	12.04	10.6905	7.8	1315.6	2.48	91	13	870901 871201
WINTER																			
1981	84.8	100.0	87.7	76.0	20.56	3.37	1.76	13.18	6.10	10.32	10.95	27.54	16.3682	14.5	7027.4	15.53	92	13	801201 810303
1982	92.3	100.0	98.4	78.1	4.24	2.30	1.97	4.70	2.66	2.98	4.01	8.96	2.7353	4.0	9160.5	17.55	91	13	811201 820302
1983	7.7	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	18.24	91	13	821130 830301
1984	61.5	100.0	81.7	79.8	4.54	2.55	0.41	4.22	2.44	6.15	3.72	10.37	3.1189	4.1	5030.0	9.78	91	13	831129 840228
1985	75.8	100.0	99.3	76.2	5.44	2.47	0.33	3.65	3.99	6.55	3.44	6.77	3.2584	3.7	4351.6	8.47	91	13	841204 850305
1986	38.5	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	13.06	91	13	851203 860304
1987	38.5	100.0	0.0	--	--	--	--	--	--	--	--	--	--	--	--	5.55	91	13	861202 870303
1988	92.3	100.0	95.4	52.5	5.74	1.23	0.95	5.35	4.66	6.06	4.85	6.06	2.5527	4.8	2002.7	5.55	91	13	871201 880301
SPRING																			
1981	76.9	92.3	78.6	103.0	6.19	2.47	0.41	2.17	10.37	5.84	2.12	12.48	3.6058	8.8	8496.7	15.53	91	13	810303 810602
1982	76.9	100.0	49.1	81.9	8.53	2.80	0.33	2.35	13.42	10.57	3.98	16.64	5.0466	7.2	5845.9	21.41	91	13	820302 820601
1983	84.6	92.3	91.8	85.8	7.24	1.89	0.38	3.22	15.36	6.89	3.67	12.77	1.5417	5.1	5658.8	10.57	91	13	830301 830531
1984	53.8	100.0	70.2	78.4	20.76	4.85	0.72	9.13	21.79	12.52	5.75	17.98	0.5383	8.7	2153.8	5.09	91	13	840228 840529
1985	61.5	100.0	92.4	98.4	14.27	3.54	0.77	4.00	24.67	17.73	4.20	19.31	1.4555	7.5	3935.6	6.38	91	13	850305 850604
1986	30.8	100.0	12.2	53.2	43.16	7.73	1.87	18.23	24.23	28.95	10.78	31.16	0.4786	13.6	440.4	10.11	91	13	860304 860603
1987	53.8	100.0	61.4	88.8	15.62	2.96	0.77	12.09	10.03	9.86	4.43	15.44	2.8445	6.8	3186.2	8.62	91	13	870303 870602
1988	69.2	100.0	100.0	44.8	26.45	4.61	1.25	12.05	11.64	11.15	6.71	19.89	0.9311	8.8	1513.6	3.17	91	13	880301 880531

SUMMER

1981	100.0	100.0	100.0	102.8	47.40	16.70	5.60	21.23	6.21	14.00	17.86	37.54	1.5812	14.8	1702.0	2.45	91	13	810602 810901
1982	92.3	100.0	99.9	102.0	19.41	5.18	1.94	5.35	19.51	21.18	7.11	20.81	6.8549	12.3	5885.2	8.56	91	13	820601 820831
1983	84.6	100.0	86.2	90.6	15.92	3.70	1.46	5.05	16.24	16.36	6.07	18.71	8.0353	10.1	5269.3	9.91	91	13	830531 830830
1984	78.6	100.0	95.6	100.2	7.24	2.22	0.66	2.04	14.36	13.40	5.11	13.64	5.3334	7.0	10820.2	16.64	98	14	840529 840904
1985	38.5	100.0	1.0	--	--	--	--	--	--	--	--	--	--	--	--	3.87	91	13	850604 850903
1986	76.9	100.0	71.4	90.5	28.34	6.09	1.89	4.96	7.10	18.32	10.35	16.31	2.3878	9.7	2559.0	5.85	91	13	860603 860902
1987	69.2	100.0	43.6	92.9	11.13	2.39	1.02	4.00	15.74	18.37	5.44	14.31	6.7298	8.3	3330.8	12.13	91	13	870602 870901
1988	100.0	100.0	100.0	79.1	21.76	4.20	1.07	6.35	11.48	16.76	11.17	18.77	1.4289	10.3	1460.3	2.72	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

SMITHS FERRY Station Number: 131500 CAL Code: ID15
Valley County, ID Elevation: 1442 meters Latitude: 44 17 52 Longitude: 116 03 49
Printed: 890427

Year	Estimates of Data Completeness ....Percent.... 1	2	3	4	Precipitation Weighted Averages .... mg/Liter .... Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	uS/cm Conduct.	Totals mL svol	cm ppt	Days	Samples	Dates
ANNUAL																			
1984	15.3	23.3	77.4	85.6	0.05	0.014	0.009	0.044	0.05	0.29	0.06	0.23	5.40	3.1	14212.1	31.61	85	12	841009 850102
1985	74.7	99.7	73.3	78.1	0.10	0.019	0.020	0.046	0.08	0.40	0.07	0.31	5.41	4.3	22377.5	56.23	363	52	850102 851231
1986	73.1	100.0	44.5	90.3	0.10	0.015	0.019	0.066	0.08	0.35	0.06	0.30	5.54	4.2	22129.6	78.65	364	52	851231 861230
1987	90.4	100.0	82.1	94.3	0.13	0.018	0.024	0.094	0.09	0.40	0.09	0.30	5.49	4.2	28080.5	53.18	364	52	861230 871229
FALL																			
1984	53.8	61.5	93.3	86.4	0.04	0.013	0.008	0.040	0.05	0.25	0.06	0.23	5.37	3.1	12386.0	22.64	56	8	841009 841204
1985	69.2	100.0	70.6	69.6	0.06	0.016	0.013	0.029	0.01	0.31	0.05	0.23	5.36	4.1	10204.9	28.32	91	13	850903 851203
1986	100.0	100.0	100.0	87.6	0.07	0.010	0.018	0.060	0.06	0.32	0.05	0.24	5.56	3.7	11642.7	18.83	91	13	860902 861202
1987	100.0	100.0	100.0	83.8	0.02	0.005	0.009	0.034	0.04	0.29	0.05	0.14	5.39	3.1	3830.4	6.73	91	13	870901 871201
WINTER																			
1985	60.4	100.0	55.6	77.9	0.07	0.016	0.012	0.052	0.03	0.41	0.06	0.30	5.29	3.9	4811.6	16.37	91	13	841204 850305
1986	38.5	100.0	1.1	100.5	0.05	0.012	0.008	0.035	0.01	0.01	0.06	0.25	5.18	4.8	294.7	39.27	91	13	851203 860304
1987	61.5	100.0	34.2	90.2	0.04	0.012	0.008	0.075	0.05	0.31	0.06	0.19	5.36	3.6	3034.3	14.49	91	13	861202 870303
1988	38.5	100.0	39.4	87.0	0.21	0.017	0.019	0.195	0.02	0.24	0.16	0.24	5.48	4.5	5716.2	24.55	91	13	871201 880301
SPRING																			
1985	84.6	100.0	96.3	86.9	0.12	0.019	0.016	0.053	0.16	0.44	0.08	0.34	5.62	3.9	8583.8	15.13	91	13	850305 850604
1986	76.9	100.0	61.6	92.2	0.13	0.020	0.015	0.065	0.12	0.36	0.07	0.37	5.60	4.6	7499.1	18.71	91	13	860304 860603
1987	100.0	100.0	100.0	96.3	0.11	0.018	0.019	0.065	0.09	0.39	0.05	0.31	5.55	3.9	12118.6	18.47	91	13	870303 870602
1988	38.5	100.0	53.8	101.1	0.12	0.015	0.009	0.076	0.10	0.36	0.05	0.32	5.52	3.6	6240.1	16.96	91	13	880301 880531
SUMMER																			
1985	69.2	100.0	34.3	100.1	1.13	0.150	0.293	0.338	0.45	2.02	0.38	1.29	5.49	18.3	603.3	2.59	91	13	850604 850903
1986	69.2	100.0	87.0	101.2	0.18	0.032	0.035	0.067	0.08	0.49	0.10	0.41	5.56	5.3	2024.1	3.42	91	13	860603 860902
1987	100.0	100.0	100.0	107.5	0.23	0.034	0.068	0.104	0.23	0.95	0.16	0.60	5.35	6.9	4359.8	6.17	91	13	870602 870901
1988	84.6	100.0	60.1	97.2	0.34	0.025	0.035	0.142	0.05	0.69	0.14	0.63	5.08	7.8	1608.1	4.08	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

SMITHS FERRY Station Number: 131500 CAL Code: ID15
Valley County, ID Elevation: 1442 meters Latitude: 44 17 52 Longitude: 116 03 49

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1984	15.3	23.3	77.4	85.6	2.54	1.15	0.23	1.91	2.94	4.61	1.58	4.83	4.0087	3.1	14212.1	31.61	85	12	841009 850102
1985	74.7	99.7	73.3	78.1	4.94	1.56	0.51	2.00	4.16	6.42	1.97	6.37	3.9264	4.3	22377.5	56.23	363	52	850102 851231
1986	73.1	100.0	44.5	90.3	4.94	1.23	0.49	2.87	4.55	5.73	1.78	6.29	2.8774	4.2	22129.6	78.65	364	52	851231 861230
1987	90.4	100.0	82.1	94.3	6.54	1.48	0.61	4.09	4.77	6.48	2.51	6.25	3.2137	4.2	28080.5	53.18	364	52	861230 871229
FALL																			
1984	53.8	61.5	93.3	86.4	1.85	1.07	0.20	1.74	3.05	4.06	1.58	4.85	4.2364	3.1	12386.0	22.64	56	8	841009 841204
1985	69.2	100.0	70.6	69.6	2.99	1.32	0.33	1.26	0.61	4.92	1.41	4.71	4.3152	4.1	10204.9	28.32	91	13	850903 851203
1986	100.0	100.0	100.0	87.6	3.69	0.82	0.46	2.61	3.38	5.15	1.38	4.94	2.7606	3.7	11642.7	18.83	91	13	860902 861202
1987	100.0	100.0	100.0	83.8	0.95	0.41	0.23	1.48	2.22	4.66	1.50	2.96	4.0458	3.1	3830.4	6.73	91	13	870901 871201
WINTER																			
1985	60.4	100.0	55.6	77.9	3.29	1.32	0.31	2.26	1.39	6.68	1.83	6.23	5.1286	3.9	4811.6	16.37	91	13	841204 850305
1986	38.5	100.0	1.1	100.5	2.50	0.99	0.20	1.52	0.55	0.24	1.69	5.21	6.6069	4.8	294.7	39.27	91	13	851203 860304
1987	61.5	100.0	34.2	90.2	1.90	0.99	0.20	3.26	2.66	4.98	1.81	3.87	4.3752	3.6	3034.3	14.49	91	13	861202 870303
1988	38.5	100.0	39.4	87.0	10.33	1.40	0.49	8.48	1.22	3.86	4.63	5.02	3.3343	4.5	5716.2	24.55	91	13	871201 880301
SPRING																			
1985	84.6	100.0	96.3	86.9	5.94	1.56	0.41	2.31	9.09	7.11	2.20	7.14	2.4044	3.9	8583.8	15.13	91	13	850305 850604
1986	76.9	100.0	61.6	92.2	6.24	1.65	0.38	2.83	6.65	5.87	2.00	7.81	2.4946	4.6	7499.1	18.71	91	13	860304 860603
1987	100.0	100.0	100.0	96.3	5.59	1.48	0.49	2.83	5.05	6.26	1.33	6.52	2.7861	3.9	12118.6	18.47	91	13	870303 870602
1988	38.5	100.0	53.8	101.1	5.94	1.23	0.23	3.31	5.38	5.87	1.38	6.77	2.9923	3.6	6240.1	16.96	91	13	880301 880531
SUMMER																			
1985	69.2	100.0	34.3	100.1	56.59	12.34	7.49	14.70	24.78	32.60	10.83	26.89	3.2211	18.3	603.3	2.59	91	13	850604 850903
1986	69.2	100.0	87.0	101.2	8.98	2.63	0.89	2.91	4.60	7.87	2.71	8.62	2.7542	5.3	2024.1	3.42	91	13	860603 860902
1987	100.0	100.0	100.0	107.5	11.63	2.80	1.74	4.52	12.86	15.29	4.43	12.54	4.4361	6.9	4359.8	6.17	91	13	870602 870901
1988	84.6	100.0	60.1	97.2	16.82	2.06	0.89	6.18	2.83	11.18	3.89	13.19	8.2985	7.8	1608.1	4.08	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

HEADQUARTERS Station Number: 130480 CAL Code: ID04
Clearwater County, ID Elevation: 969 meters Latitude: 46 37 40 Longitude: 115 49 10
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1982	29.9	45.3	67.5	99.7	0.06	0.013	0.020	0.063	0.04	0.34	0.08	0.21	5.42	3.6	21442.5	46.86	168	24	820720 830104
1983	70.7	97.8	68.2	92.5	0.06	0.016	0.020	0.048	0.06	0.33	0.09	0.35	5.33	3.8	44697.6	105.46	365	52	830104 840104
1984	77.0	99.7	81.3	94.0	0.09	0.021	0.021	0.059	0.08	0.38	0.09	0.37	5.42	3.8	55300.7	106.07	364	52	840104 850102
1985	85.2	99.7	91.4	90.9	0.08	0.016	0.019	0.036	0.03	0.23	0.06	0.28	5.26	4.1	48235.1	85.39	365	52	850102 860102
1986	76.9	97.5	84.4	95.4	0.04	0.009	0.018	0.055	0.05	0.29	0.07	0.23	5.38	3.5	47118.5	85.45	362	52	860102 861230
1987	72.8	98.1	72.6	97.0	0.08	0.014	0.030	0.105	0.06	0.35	0.10	0.28	5.40	3.9	30277.4	68.24	364	52	861230 871229
FALL																			
1982	52.2	100.0	49.8	98.0	0.08	0.021	0.025	0.080	0.08	0.52	0.12	0.39	5.28	5.4	7593.8	22.72	92	13	820831 821201
1983	76.9	100.0	84.8	90.8	0.05	0.011	0.015	0.042	0.05	0.28	0.09	0.31	5.37	3.3	15350.9	29.39	91	13	830830 831129
1984	92.3	100.0	92.9	95.0	0.06	0.020	0.019	0.079	0.06	0.25	0.10	0.28	5.39	3.5	17457.9	29.12	91	13	840904 841204
1985	85.7	100.0	99.5	92.2	0.06	0.013	0.015	0.033	0.02	0.16	0.05	0.25	5.25	4.2	18682.2	29.89	91	13	850903 851203
1986	83.5	98.9	96.0	90.8	0.05	0.009	0.035	0.095	0.05	0.34	0.11	0.23	5.33	3.7	15546.3	25.01	90	13	860903 861202
1987	84.6	100.0	92.0	91.0	0.05	0.009	0.015	0.051	0.07	0.39	0.09	0.19	5.30	4.2	3937.0	6.95	91	13	870901 871201
WINTER																			
1983	52.7	98.9	47.0	--	0.04	0.010	0.012	0.045	0.04	0.23	0.06	0.19	5.48	2.5	12159.2	38.12	90	13	821201 830301
1984	38.5	100.0	45.1	79.5	0.03	0.012	0.008	0.042	0.02	0.23	0.09	0.17	5.58	2.7	8022.6	32.96	91	13	831129 840228
1985	85.7	100.0	83.4	86.5	0.07	0.018	0.017	0.056	0.04	0.44	0.08	0.32	5.27	4.1	13235.5	27.01	91	13	841204 850305
1986	79.1	100.0	76.4	95.0	0.01	0.004	0.002	0.019	0.04	0.15	0.04	0.12	5.35	2.7	17237.9	35.01	91	13	851203 860304
1987	76.9	84.6	99.2	97.4	0.07	0.013	0.020	0.085	0.06	0.30	0.11	0.24	5.53	3.1	12133.7	18.49	91	13	861202 870303
1988	69.2	100.0	92.1	89.9	0.04	0.006	0.005	0.043	0.02	0.22	0.07	0.15	5.39	2.9	10445.8	29.74	91	13	871201 880301
SPRING																			
1983	76.9	100.0	75.9	97.7	0.09	0.019	0.021	0.052	0.09	0.35	0.08	0.38	5.41	3.7	10566.7	22.83	91	13	830301 830531
1984	100.0	100.0	100.0	97.1	0.10	0.021	0.016	0.054	0.13	0.44	0.09	0.46	5.55	3.9	22092.1	33.28	91	13	840228 840529
1985	62.6	100.0	71.0	96.2	0.14	0.021	0.035	0.034	0.04	0.31	0.07	0.32	5.39	3.7	11376.3	24.53	91	13	850305 850604
1986	76.9	100.0	87.5	95.7	0.07	0.013	0.012	0.049	0.09	0.35	0.06	0.32	5.58	3.6	12805.5	22.41	91	13	860304 860603
1987	54.9	100.0	42.6	101.5	0.13	0.022	0.068	0.220	0.07	0.44	0.10	0.41	5.43	5.1	7192.0	24.48	91	13	870303 870602
1988	100.0	100.0	100.0	92.8	0.11	0.017	0.016	0.062	0.03	0.26	0.07	0.32	5.47	3.7	19463.3	30.60	91	13	880301 880531
SUMMER																			
1982	46.2	46.2	100.0	104.0	0.19	0.035	0.062	0.109	0.12	0.68	0.13	0.53	5.55	6.0	1738.9	2.46	42	6	820720 820831
1983	76.9	100.0	71.9	98.8	0.09	0.021	0.037	0.049	0.08	0.49	0.07	0.47	5.07	6.1	9503.3	19.74	91	13	830531 830830
1984	64.3	100.0	61.3	96.9	0.25	0.042	0.070	0.058	0.04	0.69	0.10	0.61	5.35	5.4	4810.5	11.96	98	14	840529 840904
1985	100.0	100.0	100.0	87.5	0.06	0.015	0.019	0.029	0.01	0.13	0.06	0.28	5.15	4.3	9190.7	15.48	91	13	850604 850903
1986	77.2	100.0	76.7	102.3	0.08	0.016	0.035	0.042	0.01	0.40	0.05	0.37	5.15	5.3	2945.3	5.55	92	13	860603 860903
1987	82.4	100.0	78.2	100.4	0.11	0.016	0.030	0.097	0.07	0.56	0.12	0.42	5.14	5.5	5524.3	10.36	91	13	870602 870901
1988	76.9	100.0	94.4	93.5	0.18	0.021	0.026	0.117	0.02	0.16	0.14	0.40	5.21	5.8	5692.4	9.50	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

HEADQUARTERS Station Number: 130480 CAL Code: ID04
Clearwater County, ID Elevation: 969 meters Latitude: 46 37 40 Longitude: 115 49 10

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1982	29.9	45.3	67.5	99.7	3.19	1.07	0.51	2.74	2.33	5.53	2.23	4.35	3.7757	3.6	21442.5	46.86	168	24	820720 830104
1983	70.7	97.8	68.2	92.5	3.19	1.32	0.51	2.09	3.44	5.29	2.40	7.27	4.6774	3.8	44697.6	105.46	365	52	830104 840104
1984	77.0	99.7	81.3	94.0	4.54	1.73	0.54	2.57	4.32	6.08	2.62	7.81	3.8194	3.8	55300.7	106.07	364	52	840104 850102
1985	85.2	99.7	91.4	90.9	3.74	1.32	0.49	1.57	1.66	3.69	1.75	5.73	5.4450	4.1	48235.1	85.39	365	52	850102 860102
1986	76.9	97.5	84.4	95.4	2.15	0.74	0.46	2.39	3.05	4.65	1.92	4.77	4.1305	3.5	47118.5	85.45	362	52	860102 861230
1987	72.8	98.1	72.6	97.0	4.04	1.15	0.77	4.57	3.33	5.65	2.82	5.85	3.9446	3.9	30277.4	68.24	364	52	861230 871229
FALL																			
1982	52.2	100.0	49.8	98.0	4.19	1.73	0.64	3.48	4.21	8.45	3.41	8.10	5.2119	5.4	7593.8	22.72	92	13	820831 821201
1983	76.9	100.0	84.8	90.8	2.45	0.90	0.38	1.83	2.61	4.45	2.65	6.52	4.3053	3.3	15350.9	29.39	91	13	830830 831129
1984	92.3	100.0	92.9	95.0	3.24	1.65	0.49	3.44	3.38	3.98	2.88	5.77	4.1115	3.5	17457.9	29.12	91	13	840904 841204
1985	85.7	100.0	99.5	92.2	2.79	1.07	0.38	1.44	1.22	2.58	1.35	5.19	5.6494	4.2	18682.2	29.89	91	13	850903 851203
1986	83.5	98.9	96.0	90.8	2.35	0.74	0.89	4.13	2.88	5.47	3.10	4.77	4.6452	3.7	15546.3	25.01	90	13	860903 861202
1987	84.6	100.0	92.0	91.0	2.35	0.74	0.38	2.22	4.10	6.36	2.43	3.85	5.0119	4.2	3937.0	6.95	91	13	870901 871201
WINTER																			
1983	52.7	98.9	47.0	--	2.15	0.82	0.31	1.96	2.33	3.73	1.72	3.96	3.3037	2.5	12159.2	38.12	90	13	821201 830301
1984	38.5	100.0	45.1	79.5	1.65	0.99	0.20	1.83	1.05	3.66	2.43	3.62	2.6182	2.7	8022.6	32.96	91	13	831129 840228
1985	85.7	100.0	83.4	86.5	3.29	1.48	0.43	2.44	2.16	7.02	2.17	6.71	5.3703	4.1	13235.5	27.01	91	13	841204 850305
1986	79.1	100.0	76.4	95.0	0.60	0.33	0.05	0.83	2.11	2.39	1.13	2.52	4.4259	2.7	17237.9	35.01	91	13	851203 860304
1987	76.9	84.6	99.2	97.4	3.69	1.07	0.51	3.70	3.16	4.81	2.99	5.08	2.9717	3.1	12133.7	18.49	91	13	861202 870303
1988	69.2	100.0	92.1	89.9	1.80	0.49	0.13	1.87	0.89	3.56	1.86	3.04	4.0644	2.9	10445.8	29.74	91	13	871201 880301
SPRING																			
1983	76.9	100.0	75.9	97.7	4.34	1.56	0.54	2.26	4.82	5.73	2.23	7.98	3.9264	3.7	10566.7	22.83	91	13	830301 830531
1984	100.0	100.0	100.0	97.1	4.89	1.73	0.41	2.35	7.15	7.06	2.68	9.50	2.8379	3.9	22092.1	33.28	91	13	840228 840529
1985	62.6	100.0	71.0	96.2	7.09	1.73	0.89	1.48	2.22	4.98	2.09	6.73	4.1210	3.7	11376.3	24.53	91	13	850305 850604
1986	76.9	100.0	87.5	95.7	3.29	1.07	0.31	2.13	4.99	5.63	1.69	6.75	2.6122	3.6	12805.5	22.41	91	13	860304 860603
1987	54.9	100.0	42.6	101.5	6.24	1.81	1.74	9.57	3.71	7.06	2.93	8.64	3.7584	5.1	7192.0	24.48	91	13	870303 870602
1988	100.0	100.0	100.0	92.8	5.64	1.40	0.41	2.70	1.88	4.16	1.86	6.69	3.4277	3.7	19463.3	30.60	91	13	880301 880531
SUMMER																			
1982	46.2	46.2	100.0	104.0	9.58	2.88	1.59	4.74	6.38	10.94	3.72	11.00	2.8249	6.0	1738.9	2.46	42	6	820720 820831
1983	76.9	100.0	71.9	98.8	4.49	1.73	0.95	2.13	4.16	7.82	1.97	9.83	8.5310	6.1	9503.3	19.74	91	13	830531 830830
1984	64.3	100.0	61.3	96.9	12.62	3.45	1.79	2.52	2.05	11.05	2.71	12.77	4.4978	5.4	4810.5	11.96	98	14	840529 840904
1985	100.0	100.0	100.0	87.5	2.94	1.23	0.49	1.26	0.67	2.13	1.64	5.87	7.0632	4.3	9190.7	15.48	91	13	850604 850903
1986	77.2	100.0	76.7	102.3	3.74	1.32	0.89	1.83	0.61	6.39	1.35	7.67	7.0146	5.3	2945.3	5.55	92	13	860603 860903
1987	82.4	100.0	78.2	100.4	5.49	1.32	0.77	4.22	3.83	9.03	3.24	8.73	7.1945	5.5	5524.3	10.36	91	13	870602 870901
1988	76.9	100.0	94.4	93.5	8.78	1.73	0.66	5.09	0.94	2.63	3.92	8.23	6.1659	5.8	5692.4	9.50	91	13	880531 880830

LOGAN Station Number: 460120 CAL Code: UT01
Cache County, UT Elevation: 1370 meters Latitude: 41 39 30 Longitude: 111 53 49
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1983	5.8	7.7	93.0	16.2	0.46	0.100	0.052	0.743	1.35	1.94	2.23	1.38	5.69	20.7	1948.1	6.15	28	4	831206 840103
1984	73.2	100.0	90.7	93.1	0.25	0.050	0.029	0.178	0.62	0.80	0.41	0.90	5.85	8.6	32334.5	56.27	365	52	840103 850102
1985	94.2	99.7	94.4	87.0	0.36	0.058	0.035	0.232	0.46	0.87	0.53	0.75	5.66	10.0	25036.3	44.88	363	52	850102 851231
1986	80.2	100.0	69.3	87.8	0.30	0.043	0.024	0.178	0.52	0.71	0.41	0.59	6.20	8.4	30020.1	70.99	364	52	851231 861230
1987	61.8	100.0	58.7	84.9	0.32	0.054	0.030	0.392	0.80	1.03	0.76	0.79	6.17	11.1	14341.5	41.37	364	52	861230 871229
FALL																			
1984	84.6	100.0	93.1	97.7	0.25	0.052	0.025	0.197	0.45	0.73	0.41	0.82	5.89	7.7	11852.6	19.16	91	13	840904 841204
1985	100.0	100.0	100.0	84.4	0.25	0.033	0.019	0.132	0.27	0.44	0.32	0.46	5.84	6.7	11609.5	20.27	91	13	850903 851203
1986	92.3	100.0	99.0	78.0	0.19	0.036	0.027	0.217	0.49	0.72	0.53	0.61	5.88	7.8	9163.2	15.02	91	13	860902 861202
1987	84.6	100.0	95.6	80.3	0.14	0.025	0.019	0.127	1.41	1.07	0.38	0.86	6.08	10.4	2713.4	5.21	91	13	870901 871201
WINTER																			
1984	53.8	92.3	86.0	46.0	0.33	0.072	0.041	0.569	1.10	1.60	1.63	1.17	5.76	16.2	3628.0	10.36	84	12	831206 840228
1985	85.7	100.0	85.0	67.4	0.27	0.078	0.028	0.365	0.54	1.37	0.83	1.05	5.12	13.2	3543.4	9.12	91	13	841204 850305
1986	76.9	100.0	21.4	79.8	0.06	0.014	0.009	0.085	1.16	0.81	0.38	0.67	6.31	9.9	3089.7	26.72	91	13	851203 860304
1987	57.1	100.0	54.8	78.6	0.13	0.019	0.010	0.165	0.57	0.85	0.25	0.54	6.14	6.9	2126.9	7.30	91	13	861202 870303
1988	100.0	100.0	100.0	94.4	0.14	0.023	0.016	0.591	0.57	0.85	1.12	0.63	6.06	9.7	3238.9	5.11	91	13	871201 880301
SPRING																			
1984	61.5	100.0	90.4	95.1	0.26	0.040	0.020	0.154	0.79	0.63	0.24	1.00	6.37	9.0	7523.7	12.92	91	13	840228 840529
1985	92.3	100.0	91.6	98.9	0.55	0.081	0.042	0.331	0.67	1.04	0.64	0.97	6.46	11.9	5550.1	9.03	91	13	850305 850604
1986	92.3	100.0	98.6	92.0	0.41	0.047	0.020	0.156	0.38	0.61	0.31	0.54	6.54	7.8	15131.7	24.60	91	13	860304 860603
1987	41.8	100.0	39.8	81.0	0.57	0.084	0.031	0.613	0.69	0.84	1.15	0.84	6.20	14.1	4181.1	17.78	91	13	870303 870602
1988	83.5	98.9	97.3	90.0	0.54	0.068	0.038	0.197	0.73	0.87	0.38	0.79	6.59	11.5	6072.3	10.22	91	13	880301 880531
SUMMER																			
1984	85.7	100.0	98.4	92.2	0.27	0.055	0.040	0.149	0.68	0.96	0.44	0.95	5.71	9.1	10734.1	17.45	98	14	840529 840904
1985	100.0	100.0	100.0	98.7	0.57	0.091	0.080	0.275	0.68	1.28	0.79	0.96	5.86	13.7	4877.5	7.28	91	13	850604 850903
1986	61.5	100.0	69.9	90.1	0.38	0.084	0.050	0.277	0.59	1.10	0.63	0.75	6.40	11.1	2592.9	6.07	91	13	860603 860902
1987	53.8	100.0	61.4	91.0	0.43	0.088	0.068	0.284	0.75	1.62	0.60	0.96	6.39	12.0	2965.3	7.82	91	13	870602 870901
1988	92.3	100.0	74.8	99.9	0.73	0.082	0.032	0.215	0.32	0.87	0.47	1.18	6.59	13.1	1015.8	2.02	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

LOGAN Station Number: 460120 CAL Code: UT01
Cache County, UT Elevation: 1370 meters Latitude: 41 39 30 Longitude: 111 53 49

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1983	5.8	7.7	93.0	16.2	23.05	8.23	1.33	32.32	74.95	31.32	62.88	28.70	2.0277	20.7	1948.1	6.15	28	4	831206 840103
1984	73.2	100.0	90.7	93.1	12.43	4.11	0.74	7.74	34.26	12.90	11.65	18.73	1.4125	8.6	32334.5	56.27	365	52	840103 850102
1985	94.2	99.7	94.4	87.0	18.11	4.77	0.89	10.09	25.61	13.97	14.84	15.54	2.2029	10.0	25036.3	44.88	363	52	850102 851231
1986	80.2	100.0	69.3	87.8	14.92	3.54	0.61	7.74	29.05	11.47	11.71	12.33	0.6339	8.4	30020.1	70.99	364	52	851231 861230
1987	61.8	100.0	58.7	84.9	16.07	4.44	0.77	17.05	44.35	16.68	21.55	16.43	0.6776	11.1	14341.5	41.37	364	52	861230 871229
FALL																			
1984	84.6	100.0	93.1	97.7	12.57	4.28	0.64	8.57	25.17	11.73	11.51	17.12	1.3002	7.7	11852.6	19.16	91	13	840904 841204
1985	100.0	100.0	100.0	84.4	12.33	2.71	0.49	5.74	14.75	7.18	9.14	9.60	1.4355	6.7	11609.5	20.27	91	13	850903 851203
1986	92.3	100.0	99.0	78.0	9.43	2.96	0.69	9.44	27.22	11.68	14.87	12.66	1.3213	7.8	9163.2	15.02	91	13	860902 861202
1987	84.6	100.0	95.6	80.3	6.89	2.06	0.49	5.52	78.17	17.28	10.80	17.89	0.8375	10.4	2713.4	5.21	91	13	870901 871201
WINTER																			
1984	53.8	92.3	86.0	46.0	16.37	5.92	1.05	24.75	60.87	25.73	45.98	24.33	1.7219	16.2	3628.0	10.36	84	12	831206 840228
1985	85.7	100.0	85.0	67.4	13.42	6.42	0.72	15.88	29.99	22.11	23.41	21.79	7.5336	13.2	3543.4	9.12	91	13	841204 850305
1986	76.9	100.0	21.4	79.8	2.99	1.15	0.23	3.70	64.31	13.03	10.78	13.98	0.4943	9.9	3089.7	26.72	91	13	851203 860304
1987	57.1	100.0	54.8	78.6	6.44	1.56	0.26	7.18	31.43	13.63	6.94	11.14	0.7194	6.9	2126.9	7.30	91	13	861202 870303
1988	100.0	100.0	100.0	94.4	7.09	1.89	0.41	25.71	31.55	13.73	31.71	13.04	0.8650	9.7	3238.9	5.11	91	13	871201 880301
SPRING																			
1984	61.5	100.0	90.4	95.1	12.97	3.29	0.51	6.70	44.02	10.18	6.66	20.75	0.4276	9.0	7523.7	12.92	91	13	840228 840529
1985	92.3	100.0	91.6	98.9	27.35	6.66	1.07	14.40	37.20	16.76	18.03	20.18	0.3444	11.9	5550.1	9.03	91	13	850305 850604
1986	92.3	100.0	98.6	92.0	20.46	3.87	0.51	6.79	21.07	9.87	8.89	11.19	0.2891	7.8	15131.7	24.60	91	13	860304 860603
1987	41.8	100.0	39.8	81.0	28.39	6.91	0.79	26.67	38.03	13.48	32.41	17.41	0.6383	14.1	4181.1	17.78	91	13	870303 870602
1988	83.5	98.9	97.3	90.0	26.70	5.59	0.97	8.57	40.64	14.00	10.61	16.50	0.2582	11.5	6072.3	10.22	91	13	880301 880531
SUMMER																			
1984	85.7	100.0	98.4	92.2	13.32	4.52	1.02	6.48	37.59	15.57	12.38	19.71	1.9364	9.1	10734.1	17.45	98	14	840529 840904
1985	100.0	100.0	100.0	98.7	28.24	7.49	2.05	11.96	37.48	20.71	22.34	20.02	1.3646	13.7	4877.5	7.28	91	13	850604 850903
1986	61.5	100.0	69.9	90.1	18.86	6.91	1.28	12.05	32.88	17.74	17.74	15.60	0.3954	11.1	2592.9	6.07	91	13	860603 860902
1987	53.8	100.0	61.4	91.0	21.21	7.24	1.74	12.35	41.36	26.05	17.01	20.06	0.4064	12.0	2965.3	7.82	91	13	870602 870901
1988	92.3	100.0	74.8	99.9	36.38	6.75	0.82	9.35	17.52	14.08	13.15	24.62	0.2594	13.1	1015.8	2.02	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PALOUSE CONSERVATION FARM Station Number: 492420 CAL Code: WA24
Whitman County, WA Elevation: 766 meters Latitude: 46 45 38 Longitude: 117 11 05
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1985	28.8	36.5	80.2	95.9	0.08	0.019	0.025	0.046	0.17	0.43	0.08	0.45	5.26	5.5	8121.8	15.42	133	19	850820 851231
1986	84.9	100.0	96.6	90.4	0.06	0.013	0.018	0.049	0.11	0.37	0.08	0.41	5.37	4.7	30636.4	51.69	364	52	851231 861230
1987	88.5	100.0	96.5	86.3	0.08	0.016	0.036	0.067	0.17	0.48	0.10	0.44	5.53	4.3	22190.0	39.28	364	52	861230 871229
FALL																			
1985	84.6	92.3	88.7	95.8	0.08	0.019	0.027	0.046	0.19	0.44	0.08	0.43	5.37	5.0	7353.2	12.63	91	13	850903 851203
1986	92.3	100.0	98.7	88.8	0.05	0.011	0.019	0.061	0.17	0.41	0.08	0.47	5.38	5.3	9584.5	16.10	91	13	860902 861202
1987	92.3	100.0	93.6	82.7	0.05	0.010	0.032	0.062	0.17	0.36	0.08	0.37	5.59	3.6	1881.5	3.59	91	13	870901 871201
WINTER																			
1986	100.0	100.0	100.0	88.9	0.02	0.007	0.006	0.031	0.05	0.24	0.06	0.29	5.28	3.8	11403.5	18.90	91	13	851203 860304
1987	92.3	100.0	99.9	77.8	0.07	0.016	0.015	0.091	0.13	0.42	0.12	0.48	5.40	4.4	5695.8	10.81	91	13	861202 870303
1988	76.9	100.0	96.7	82.9	0.05	0.009	0.011	0.054	0.06	0.23	0.09	0.37	5.32	3.8	8521.6	15.66	91	13	871201 880301
SPRING																			
1986	76.9	100.0	95.6	93.0	0.12	0.021	0.022	0.053	0.12	0.29	0.08	0.49	5.74	4.9	6588.2	10.92	91	13	860304 860603
1987	84.6	100.0	96.5	89.1	0.10	0.019	0.055	0.059	0.20	0.55	0.09	0.50	5.65	4.6	6690.0	11.48	91	13	870303 870602
1988	76.9	100.0	85.1	92.1	0.14	0.020	0.028	0.069	0.10	0.40	0.06	0.43	5.69	4.1	8858.4	16.22	91	13	880301 880531
SUMMER																			
1985	0.0	15.4	0.0	--	--	--	--	--	--	--	--	--	--	--	--	1.63	14	2	850820 850903
1986	78.0	100.0	78.7	101.7	0.12	0.026	0.056	0.049	0.05	0.92	0.09	0.55	5.09	7.4	2708.6	5.02	91	13	860603 860902
1987	84.6	100.0	92.9	96.7	0.10	0.019	0.058	0.075	0.27	0.86	0.09	0.56	5.36	6.5	4816.1	7.90	91	13	870602 870901
1988	84.6	100.0	64.6	90.6	0.18	0.030	0.035	0.138	0.06	0.89	0.20	0.61	5.28	7.4	2483.7	6.25	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

PALOUSE CONSERVATION FARM Station Number: 492420 CAL Code: WA24
Whitman County, WA Elevation: 766 meters Latitude: 46 45 38 Longitude: 117 11 05

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1985	28.8	36.5	80.2	95.9	3.74	1.56	0.64	2.00	9.42	6.97	2.26	9.44	5.4702	5.5	8121.8	15.42	133	19	850820 851231
1986	84.9	100.0	96.6	90.4	2.89	1.07	0.46	2.13	6.04	5.94	2.12	8.54	4.2364	4.7	30636.4	51.69	364	52	851231 861230
1987	88.5	100.0	96.5	86.3	3.99	1.32	0.92	2.91	9.42	7.77	2.74	9.19	2.9648	4.3	22190.0	39.28	364	52	861230 871229
FALL																			
1985	84.6	92.3	88.7	95.8	3.89	1.56	0.69	2.00	10.37	7.13	2.17	8.87	4.2267	5.0	7353.2	12.63	91	13	850903 851203
1986	92.3	100.0	98.7	88.8	2.40	0.90	0.49	2.65	9.42	6.55	2.37	9.89	4.1305	5.3	9584.5	16.10	91	13	860902 861202
1987	92.3	100.0	93.6	82.7	2.40	0.82	0.82	2.70	9.37	5.81	2.31	7.79	2.5942	3.6	1881.5	3.59	91	13	870901 871201
WINTER																			
1986	100.0	100.0	100.0	88.9	0.95	0.58	0.15	1.35	2.88	3.81	1.72	5.98	5.3088	3.8	11403.5	18.90	91	13	851203 860304
1987	92.3	100.0	99.9	77.8	3.44	1.32	0.38	3.96	7.32	6.76	3.44	9.92	3.9628	4.4	5695.8	10.81	91	13	861202 870303
1988	76.9	100.0	96.7	82.9	2.69	0.74	0.28	2.35	3.55	3.74	2.45	7.81	4.7863	3.8	8521.6	15.66	91	13	871201 880301
SPRING																			
1986	76.9	100.0	95.6	93.0	5.89	1.73	0.56	2.31	6.71	4.74	2.14	10.19	1.8408	4.9	6588.2	10.92	91	13	860304 860603
1987	84.6	100.0	96.5	89.1	4.89	1.56	1.41	2.57	10.87	8.94	2.54	10.37	2.2594	4.6	6690.0	11.48	91	13	870303 870602
1988	76.9	100.0	85.1	92.1	7.19	1.65	0.72	3.00	5.82	6.42	1.72	8.92	2.0230	4.1	8858.4	16.22	91	13	880301 880531
SUMMER																			
1985	0.0	15.4	0.0	--	--	--	--	--	--	--	--	--	--	--	--	1.63	14	2	850820 850903
1986	78.0	100.0	78.7	101.7	5.89	2.14	1.43	2.13	2.99	14.87	2.48	11.39	8.1846	7.4	2708.6	5.02	91	13	860603 860902
1987	84.6	100.0	92.9	96.7	5.19	1.56	1.48	3.26	15.14	13.84	2.68	11.66	4.3652	6.5	4816.1	7.90	91	13	870602 870901
1988	84.6	100.0	64.6	90.6	9.18	2.47	0.89	6.00	3.38	14.36	5.70	12.64	5.2360	7.4	2483.7	6.25	91	13	880531 880830

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

SULLIVAN LAKE Station Number: 491540 CAL Code: WA15
Pend Oreille County, WA Elevation: 796 meters Latitude: 48 50 36 Longitude: 117 17 02
Printed: 890427

	Estimates of Data Completeness				Precipitation Weighted Averages										Totals				
	Percent				mg/Liter									uS/cm	mL	cm			
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	pH	Conduct.	svol	ppt	Days	Samples	Dates
ANNUAL																			
1984	55.9	65.5	72.5	80.4	0.14	0.030	0.032	0.064	0.08	0.51	0.09	0.51	5.23	5.3	21509.0	54.41	239	34	840508 850102
1985	77.2	99.7	71.1	89.5	0.15	0.025	0.021	0.044	0.03	0.35	0.07	0.42	5.27	4.9	19412.1	44.39	363	52	850102 851231
1986	84.3	98.1	83.8	96.1	0.11	0.016	0.021	0.039	0.04	0.35	0.06	0.38	5.33	4.4	33708.6	61.58	364	52	851231 861230
1987	67.3	90.4	79.9	87.8	0.13	0.019	0.029	0.093	0.10	0.57	0.08	0.46	5.28	5.4	22835.0	47.90	329	47	861230 871124
FALL																			
1984	84.6	100.0	72.9	88.5	0.10	0.023	0.034	0.056	0.06	0.40	0.09	0.40	5.18	4.9	10076.1	23.02	91	13	840904 841204
1985	93.4	100.0	92.4	97.1	0.13	0.021	0.015	0.036	0.04	0.33	0.07	0.36	5.39	4.1	11875.4	19.47	91	13	850903 851203
1986	92.3	100.0	97.5	97.7	0.07	0.009	0.016	0.041	0.05	0.32	0.06	0.28	5.33	3.8	11140.3	17.18	91	13	860902 861202
1987	52.7	84.6	64.0	100.1	0.13	0.016	0.019	0.057	0.09	0.79	0.08	0.50	5.07	6.8	3788.5	8.71	84	12	870901 871124
WINTER																			
1985	85.7	100.0	99.9	57.9	0.13	0.033	0.015	0.079	0.04	0.46	0.08	0.37	5.29	4.6	6576.1	16.76	91	13	841204 850305
1986	69.2	100.0	60.6	83.5	0.08	0.010	0.007	0.023	0.01	0.23	0.05	0.17	5.40	3.4	5599.7	16.31	91	13	851203 860304
1987	84.8	100.0	94.9	72.1	0.07	0.010	0.017	0.136	0.09	0.41	0.09	0.30	5.35	4.0	7436.4	16.00	92	13	861202 870304
SPRING																			
1984	23.1	23.1	100.0	99.4	0.20	0.027	0.023	0.044	0.13	0.56	0.10	0.77	5.38	5.7	3908.3	5.79	21	3	840508 840529
1985	46.2	100.0	13.2	75.8	0.51	0.072	0.115	0.106	0.10	0.44	0.17	1.12	5.30	9.6	705.7	10.36	91	13	850305 850604
1986	83.5	100.0	89.4	96.6	0.17	0.023	0.022	0.036	0.03	0.22	0.06	0.50	5.51	4.7	8429.8	14.38	91	13	860304 860603
1987	76.9	98.9	70.7	92.3	0.10	0.018	0.037	0.052	0.12	0.55	0.06	0.46	5.30	5.1	6759.7	16.04	90	13	870304 870602
SUMMER																			
1984	78.6	100.0	32.0	100.3	0.28	0.052	0.092	0.077	0.17	1.01	0.12	0.95	5.22	8.1	2784.8	12.81	98	14	840529 840904
1985	92.3	100.0	97.4	99.3	0.11	0.024	0.025	0.038	0.01	0.42	0.06	0.57	4.97	6.7	4454.8	6.76	91	13	850604 850903
1986	84.6	100.0	68.2	105.1	0.19	0.036	0.048	0.055	0.06	0.70	0.10	0.71	5.15	7.4	5742.6	11.84	91	13	860603 860902
1987	84.6	100.0	92.5	101.8	0.20	0.027	0.037	0.069	0.08	0.61	0.09	0.54	5.32	5.9	8186.5	12.84	91	13	870602 870901

NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/ NATIONAL TRENDS NETWORK

PRECIPITATION WEIGHTED AVERAGES REPORTED IN MICROEQUIVALENTS/LITER
Printed: 890427

SULLIVAN LAKE Station Number: 491540 CAL Code: WA15
Pend Oreille County, WA Elevation: 796 meters Latitude: 48 50 36 Longitude: 117 17 02

	Completeness Estimates				Precipitation Weighted Averages										Totals				
	Percent				Microequivalents/Liter									uS/cm	mL	cm		Sam-	
Year	1	2	3	4	Ca	Mg	K	Na	NH4	NO3	Cl	SO4	H	Cond.	svol	ppt	Days	ples	Dates
ANNUAL																			
1984	55.9	65.5	72.5	80.4	7.09	2.47	0.82	2.78	4.27	8.27	2.57	10.66	5.9429	5.3	21509.0	54.41	239	34	840508 850102
1985	77.2	99.7	71.1	89.5	7.34	2.06	0.54	1.91	1.88	5.69	2.00	8.79	5.3334	4.9	19412.1	44.39	363	52	850102 851231
1986	84.3	98.1	83.8	96.1	5.39	1.32	0.54	1.70	2.38	5.60	1.78	7.94	4.6452	4.4	33708.6	61.58	364	52	851231 861230
1987	67.3	90.4	79.9	87.8	6.49	1.56	0.74	4.05	5.65	9.18	2.37	9.48	5.2119	5.4	22835.0	47.90	329	47	861230 871124
FALL																			
1984	84.6	100.0	72.9	88.5	5.19	1.89	0.87	2.44	3.33	6.47	2.57	8.42	6.6222	4.9	10076.1	23.02	91	13	840904 841204
1985	93.4	100.0	92.4	97.1	6.39	1.73	0.38	1.57	2.22	5.26	1.89	7.50	4.1115	4.1	11875.4	19.47	91	13	850903 851203
1986	92.3	100.0	97.5	97.7	3.69	0.74	0.41	1.78	2.88	5.15	1.75	5.73	4.6881	3.8	11140.3	17.18	91	13	860902 861202
1987	52.7	84.6	64.0	100.1	6.69	1.32	0.49	2.48	4.99	12.66	2.34	10.37	8.5507	6.8	3788.5	8.71	84	12	870901 871124
WINTER																			
1985	85.7	100.0	99.9	57.9	6.24	2.71	0.38	3.44	2.38	7.34	2.23	7.79	5.1761	4.6	6576.1	16.76	91	13	841204 850305
1986	69.2	100.0	60.6	83.5	3.99	0.82	0.18	1.00	0.83	3.76	1.30	3.65	4.0087	3.4	5599.7	16.31	91	13	851203 860304
1987	84.8	100.0	94.9	72.1	3.54	0.82	0.43	5.92	5.05	6.55	2.54	6.19	4.4566	4.0	7436.4	16.00	92	13	861202 870304
SPRING																			
1984	23.1	23.1	100.0	99.4	9.78	2.22	0.59	1.91	6.99	9.05	2.85	15.98	4.1591	5.7	3908.3	5.79	21	3	840508 840529
1985	46.2	100.0	13.2	75.8	25.30	5.92	2.94	4.61	5.43	7.10	4.65	23.25	4.9888	9.6	705.7	10.36	91	13	850305 850604
1986	83.5	100.0	89.4	96.6	8.23	1.89	0.56	1.57	1.77	3.56	1.64	10.37	3.0974	4.7	8429.8	14.38	91	13	860304 860603
1987	76.9	98.9	70.7	92.3	4.99	1.48	0.95	2.26	6.71	8.86	1.75	9.54	4.9545	5.1	6759.7	16.04	90	13	870304 870602
SUMMER																			
1984	78.6	100.0	32.0	100.3	14.17	4.28	2.35	3.35	9.48	16.26	3.33	19.85	6.0395	8.1	2784.8	12.81	98	14	840529 840904
1985	92.3	100.0	97.4	99.3	5.29	1.97	0.64	1.65	0.83	6.81	1.58	11.89	10.8393	6.7	4454.8	6.76	91	13	850604 850903
1986	84.6	100.0	68.2	105.1	9.28	2.96	1.23	2.39	3.10	11.31	2.74	14.79	7.0146	7.4	5742.6	11.84	91	13	860603 860902
1987	84.6	100.0	92.5	101.8	9.93	2.22	0.95	3.00	4.60	9.76	2.40	11.33	4.8195	5.9	8186.5	12.84	91	13	870602 870901